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How Germany Became Europe's Green Leader: A Look at Four Decades of Sustainable Policymaking

By Ralph Buehler, Arne Jungjohann, Melissa Keeley, Michael Mehling



Melissa Keeley

Green roofs like this one in Berlin, Germany, support specialized, hearty vegetation and provide environmental services such as stormwater retention, urban heat island effect amelioration, habitat for urban wildlife, and energy savings resulting from better insulation. Over the past 40 years, German policies have successfully encouraged green innovation and infrastructure.

Key Concepts

- Germany's experience with policies aimed at "greening" the economy provides several lessons for the United States about how to make sustainability politically acceptable in a federal system of government:
- Start small and implement policies in stages. Many sustainability policies in Germany were first implemented at a small geographic scale or with a small scope. Successful pilot projects were expanded in stages over time.
- There is no silver bullet. Policies have to be coordinated and integrated across sectors and levels of government to achieve maximum effectiveness.
- Foster citizen participation and communicate policies effectively. Citizen input reduces potential legal challenges, increases public acceptance, and has the potential to improve projects and outcomes.
- Find innovative solutions and embrace bipartisanship. Successful green policies in Germany were designed to meet the needs of multiple constituents.

In Brief Over the last 40 years, all levels of government in Germany have retooled policies to promote growth that is more environmentally sustainable. Germany's experiences can provide useful lessons for the United States (and other nations) as policymakers consider options for "green" economic transformation. Our analysis focuses on four case studies from Germany in the areas of energy, urban infrastructure, and transportation. We show how political challenges to the implementation of green policies were overcome and how sustainability programs were made politically acceptable at the local, state, and federal levels of government. Within the three highlighted sectors, we identify potential opportunities and barriers to policy transfer from Germany to the United States, concluding with specific lessons for policy development and implementation.

How does one "green" an economy? For governments seeking a cleaner, more efficient, and ultimately more sustainable pathway to economic prosperity, this question entails both promise and great challenges. For one, the scale of transformation it requires is exceptionally daunting: in his 2011 State of the Union speech, for instance, President Barack Obama called on the United States to generate 80 percent of its electricity from clean energy sources and to give 80 percent of Americans access to high-speed rail, both within 25 years.¹ Compared to where the country stands now, these objectives presuppose unprecedented levels of investment in new infrastructure, new technologies, and relevant skills and education; yet at the same time, they also hold the prospect of new opportunities for job growth, innovation, industrial efficiency, and energy independence. With that in mind, one will invariably wonder, is such a transformation feasible at a time of constrained public budgets and slowly recovering economies? And perhaps more importantly, are the expected benefits of such a green transformation compelling enough to persuade a public that is exposed to conflicting messages about the underlying rationale, is critical of new regulation and expenditure, and generally is disillusioned with political authority?

Fortunately, the green transformation of economies is no longer a theoretical concept. Several nations have put the green economy to the test. While far from being the only country to venture down this path, Germany has earned wide recognition for its successful alignment of prosperous and sustainable growth. Unlike many of its European

neighbors, Germany has emerged from the recent recession with a robust economy, thanks in large part to flourishing

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exports. Germany has a dominant market share in various green technologies as well as a substantial part of its workforce employed in the environmental sector.² Meanwhile, greenhouse gas emissions have fallen in absolute terms, effectively decoupling economic growth from Germany's environmental footprint.

Admittedly, not all factors contributing to this success story can be replicated in other countries and regions: challenged with scarce natural resources and a high population density, Germans have traditionally been forced to embrace sustainability in virtually all facets of economic activity, from land use to transportation. Historical transition processes, such as postwar reconstruction and, more recently, the reunification of East and West Germany, also resulted in the renewal of infrastructure and replacement of outdated industrial facilities.

Still, the greening of the German economy is also unmistakably the product of several decades of targeted policy design and implementation, particularly in the past decade. Policies related to environmental protection and resource conservation have been mainstreamed in all areas of economic activity and have been described by a former government minister as central to Germany's recent success: "green policy is merely good industrial policy."³ Drawing on a series of relevant case studies, this article shows that the transformation witnessed in Germany would not have been conceivable without the policy decisions that preceded it. Each case study—energy taxation, renewable-energy promotion, green infrastructure, and sustainable transportation—offers valuable insights into how to design and implement green policies.

Pricing Energy for Jobs and Resource Conservation: Germany's Energy Tax Reform

After months of heated political debate, especially regarding the role of nuclear power in Germany's energy mix, the federal government adopted its new *Energy Concept* document in September 2010, setting out a broad framework for German energy policy until 2050. Developed by the ruling center-right coalition, this document aims at turning Germany into one of the "most energy efficient and greenest economies in the world, while enjoying competitive energy prices and a high level of prosperity."⁴ In line with a campaign pledge set out in the government's coalition agreement, the new energy policy defines ambitious targets for the medium and longer term: primary energy consumption is to fall by 20 percent from 2008 levels by 2020, and at least 50 percent by 2050; renewable energy is to account for 18 percent of final energy consumption in 2020, and at least 80 percent of electricity consumption in 2050; and greenhouse gas emissions are to see cuts of 40 percent by 2020 and at least 80 percent by 2050, both relative to 1990 levels.

Energy pricing through taxes and other fiscal instruments has traditionally held a prominent position in the German energy policy mix. As any visitor to Germany will be quick to notice, gasoline prices are significantly higher than in most other regions: in early 2011, a gallon of regular gasoline cost over U.S.\$7, more than double the average price in the United States. The price difference is almost entirely due to higher tax rates on oil and other fuels, a system of excise taxes that dates back to prewar Germany and has since been harmonized at the European level. It was not until the late 1990s, however, that energy taxation also became a vehicle for Germany's green agenda. In 1998, a center-left coalition of Social Democrats and Green Party members pledged to introduce new fiscal instruments to reduce the tax burden on labor and shift part of it to energy consumption. This campaign promise sought to harness the multiple dividends invoked by advocates of environmental taxes, including greater flexibility and cost efficiency than traditional regulation, incentives to develop innovative clean technologies, and the ability to raise revenues for public investments or tax cuts in other areas, such as labor costs.⁵

In 1999, the German legislature passed the Ecological Tax Reform Act, which mandated gradual increases in the tax rates on oil and gas and introduced a new levy on electricity.⁶ This initiative was by no means uncontroversial. From the outset, it encountered public opposition triggered by rising prices for crude oil and concerns over industrial competitiveness. Resistance to this measure was, in fact, so great that many observers expected the energy tax project to be a casualty of partisan politics. And yet, in 2006, new legislation by the European Union and a change of government in Germany, coupled with a yawning gap in the federal budget, heralded a new chapter in German energy taxation. That year, the legislature adopted a comprehensive Energy Tax Act, setting up a common fiscal framework for energy products through harmonized definitions, taxation rules, and exemptions.⁷ This important step led to a complete revision of the framework for energy taxation in Germany, effectively ending years of deadlock in Parliament; but critics were also quick to say it would do little to help transform the German economy. Nearly half a decade later, what has the German energy tax reform achieved?

A Positive Macroeconomic Balance

Between 1999 and 2003, Germany's energy tax reform resulted in a gradual increase in energy costs. A number of exceptions motivated by social and economic considerations were initially included to safeguard the competitiveness of the manufacturing, agricultural, and forestry sectors and to avoid undue hardship for lower-income households. Overall, however, the fiscal burden resulting from the energy tax reform has been moderate compared to already existing taxes: for instance, only €0.15 of the €0.66 currently charged as taxes on every liter of gasoline is a result of the tax reform, with the far greater share originating in the excise taxes already imposed prior to 1999. Altogether, the share of environmentally motivated taxes in the overall tax revenue only rose from 5.2 percent in 1998 to 6.5 percent in 2003 and has since declined again to 5.3 percent in 2008, nearly the level where it started in 1999.⁸ Not only does this reflect the fact that other tax categories—notably value-added taxation—have seen greater increases in recent years, but it also is a direct consequence of changing energy consumption patterns.

Fossil fuel consumption has continually declined in Germany since the introduction of the energy tax reform. According to the German Federal Statistical Office, gasoline consumption in 2000 decreased by 4.5 percent compared to the previous year, and it continued to decrease in 2001 and 2002 by 3 and 3.3 percent, respectively, exceeding the previous average reduction of 2 percent due to general improvements in vehicle technology and transportation planning. The targeted increase in energy costs has also created an identifiable incentive for behavioral change in other sectors, encouraging deployment of energy-efficient technologies and processes, including alternative energy sources. Reductions of CO₂ emissions are estimated to have reached 3 percent annually, equivalent to 24 million metric tons of CO₂.⁹ At the same time, revenues of the energy tax reform have been almost fully returned to taxpayers, with the largest share used for a gradual reduction of social security contributions. In 2003, for instance, roughly €16.1 billion raised through the tax reform was used to reduce and stabilize nonwage labor costs, allowing pension contributions to be

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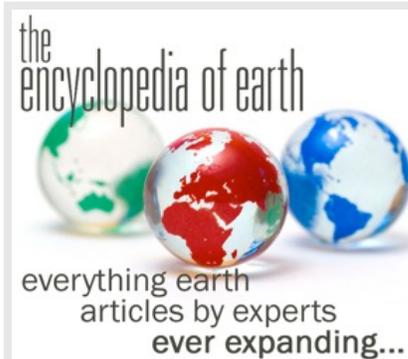


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lowered by 1.7 percent.¹⁰ With hiring rendered less expensive, the energy tax reform has helped promote employment and has contributed to the creation of an estimated 250,000 new jobs. A smaller fraction of proceeds has been used to subsidize the deployment of renewable-energy projects and the modernization of buildings.

Lessons from Energy Pricing in Germany

Like everywhere else, taxes are a politically sensitive issue in Germany. Unsurprisingly, opponents of the energy tax reform—including the current ruling coalition—were quick to launch a determined media campaign against the proposed legislation. Given the complexities of its design, it was easy for critics to portray the tax reform as a mere increase in the fiscal burden, while downplaying or disputing the accompanying reduction in labor costs and expected employment benefits. Germany's parliamentary system and its strict party discipline allowed the governing coalition at the time to pass the tax reform against partisan resistance. In countries with different legislative processes, that option may not be available. Ironically, the need to close a growing budget deficit has made the current conservative government, previously an ardent adversary of environmentally motivated taxes, now dependent on the revenue created by the energy tax. As the rationale and benefits of the tax reform have become more widely known, there has been greater public acceptance of the incremental increase in energy cost.

It stands to reason that better communication in the initial stages of the tax reform could have alleviated some of the early concerns. Also, its portrayal as an environmentally motivated tax may have incurred avoidable partisan strife. And focusing on the innovation and employment benefits of the proposed tax may have been strategically preferable. And clearly, a gradual and transparent trajectory of rate hikes was of central importance in making the tax reform acceptable in the first place. Ultimately, however, the positive outcome of the tax reform is the most compelling lesson from the German experience: contrary to the early fears, substantial change and innovation prompted by the rising energy prices have actually strengthened the German economy. Energy-efficient technologies are now among the fastest-growing export products, and the incentive to reduce energy use has helped the German economy become more resilient to fluctuations in global oil and gas prices. Overall, greater efficiency throughout the economy has translated into lower energy costs for households and industry. Despite imposing higher energy tax rates, average German utility bills and fuel expenditures tend to match or lie below those seen in the United States. As the Federal Environmental Agency has concluded, the Ecological Tax Reform Act delivered on its promise of improved labor conditions and greater sustainability, resulting in what the agency describes as "in a typically German understatement, as a positive macroeconomic balance."¹¹

Promoting Renewable Energy

As a member state of the European Union (EU), Germany's energy policies are driven by a mix of national and European legislation. Formally, the 27 EU member states regulate energy policies within their own national borders. However, EU treaty provisions concerning the European internal market, free competition, and environmental protection have created a European energy policy.¹²

In 2009, a major piece of renewable-energy legislation was passed as part of an overall climate and energy package.

The European Union's Renewable Energy Directive¹³ requires each member state to increase its share of renewable energy—such as solar, wind power, biomass, or hydroelectric—to raise the overall share from 8.5 percent in 2010 to 20 percent by 2020 across all sectors (e.g., power generation, heating and cooling, and transportation fuels).

Achievements in Renewable Energy

Germany has seen a remarkable expansion of renewable energy in the last decade. The share of renewable energy in electricity generation rose from 6 percent in 2000 to 16 percent in 2009.¹⁴ Over this time, the German government revised its own targets twice, given that the previous targets had been exceeded ahead of schedule. The German government is expecting a share of 38 percent renewable power by 2020 and continues to drive the transformation "towards an energy system based completely on renewable energies."^{15,16}

The economic benefits of this development are impressive. By 2010, the field of renewable-energy-related jobs employed around 340,000 people, most of them in biomass, wind power, and solar.¹⁷ In comparison, the German lignite industry employs only 50,000 people—from mining to the power plant.¹⁸ The key policy responsible for this success is the Renewable Energy Sources Act, first enacted in April 2000.¹⁹ This feed-in tariff policy is embedded in a climate and energy policy framework that promotes renewable energy and efficiency technologies, including laws to encourage combined-heat-and-power plants, a cap and trade system, the energy tax reform described earlier in the article, and several additional measures. The next planned revision to the law will aim to incentivize grid access and grid improvement, offshore wind power, and technologies for peak management and power storage.²⁰

Comparison with Renewable-Energy Practice in the United States

The United States currently employs a mix of short-term tax credits, loan guarantees, state-level renewable portfolio standards, and limited feed-in tariffs. In contrast to Germany, the U.S. policy framework has evolved less quickly at the federal level, where time horizons have been shorter-term. The uncertainty engendered by this short-term policy framework has led to repeated falloffs in renewable-energy capacity additions in the United States as support measures have neared expiration.²¹ For example, in contrast to Germany, new wind turbine construction in America has fluctuated greatly from year to year, because incentives have repeatedly expired.²² Even with this policy uncertainty, however, the United States in 2008 still led the world in total installed wind-power capacity, with 20.8 percent.²³ In 2008, renewable energy provided 9 percent of electricity production in the United States, with large-scale hydropower being the largest source.²⁴



Ralph Buehler
The light rail system in the car-free city center of Freiburg, Germany. In the mid-1970s Freiburg was the first German city to ban cars from a network of streets in its city center.

In many ways, the United States relies more on a state-level approach through renewable portfolio standards to



Ralph Buehler

Cyclists on Freiburg's car-free Wiwili bridge. The bridge was closed to cars in the early 2000s and is now open only to cyclists and pedestrians.

increase renewable-energy capacity. These standards require power companies to provide a certain proportion of electricity from renewable-energy sources. Currently, renewable portfolio standards regulations apply in 29 states and in the District of Columbia; five additional states have established targets for renewable expansion.²⁵ In many cases, long-term supply contracts for green power have been signed. Typical target percentages for green power are 15 percent for 2015, 20 percent for 2020, and 25 percent for 2025. These figures are significantly lower than the target set in Europe (21 percent for 2010).²⁶

Feed-in tariff policies, the most

common renewable-energy policy in the world,²⁷ are slowly spreading in the United States. In most cases, these policies guarantee grid access and a 20-year premium contract for renewable energy technologies. As of January 2011, Gainesville Regional Utilities, Hawaii, and Vermont have adopted feed-in tariff policies based on the cost of generation. Maine and California have also adopted a light version of a feed-in tariff, though in California legal struggles are being fought. In addition, representatives in ten different state legislatures have proposed different feed-in tariff models.²⁸

Transferable Lessons for Renewable Energy in the United States

The German success in rapid renewable-energy deployment relies on a robust feed-in tariff law and an overall comprehensive climate and energy framework with a long-term perspective. This policy environment comes with streamlined administrative procedures that help shorten lead times and bureaucratic overhead and that minimize project costs. All of the above create a high investment certainty that the United States overall and most of its states independently currently lack.

Given the abundance of natural resources (e.g., wind, biomass, solar) in the United States, the deployment of renewable energy should be cheaper than in Germany, which has an average solar input close to that of Alaska (and Iowa's cornfields alone, which could be used for biogas production, are double the size of Germany's agricultural land).²⁹

Across the political spectrum, all major German parties support an industrial transformation toward a low-carbon economy, and there is a strong consensus concerning the need to address climate change. Constituent groups from both the progressive (e.g., renewable-energy industry) and conservative side (e.g., farm community) benefit from this approach. The understanding is that strong environmental policies drive ecological modernization and create new market opportunities. Germany as an export-oriented country aims to sell the solutions to a carbon-constrained and high-energy-price world.³⁰ By contrast, the United States lags behind, where political debates over climate-change-related policy actions are hindering opportunities and leadership in this arena. As long as the public perceives a trade-off between environmental regulation and industrial competitiveness, it will be extremely difficult for the United States to fundamentally turn toward a low-carbon economy. U.S. policymakers should adjust elements of a feed-in tariff policy to regional contexts to drive rapid growth in renewable-electricity markets, to promote strong manufacturing industries, and to create new jobs in a cost-effective manner.

Encouraging Green Infrastructure

Over the past 40 years, northern Europe, and Germany in particular, has been a hotbed for the innovation and application of green technologies to enhance the urban environment.³¹ These technologies, sometimes referred to as green infrastructure or low-impact development, include such innovations as green roofs, green facades, and permeable pavements. They mimic the natural processes of soils and vegetation to provide "environmental services" such as stormwater management, urban heat island amelioration, and habitat, even in dense urban areas.³²⁻³⁸ What is clear is that the proliferation of green roofs and other green infrastructure in Germany has been supported by a complex assortment of incentives and requirements at multiple levels of government.³¹ Significantly, federal nature-protection laws and building codes require "compensation," or restoration, for human impairment of natural landscapes and of environmental services in greenfield developments (development on previously undeveloped land).³⁹ In many cases, green infrastructure techniques can be used to fulfill these requirements. Federal laws also require that German states create landscape plans.⁴⁰ As a result, German states have innovated a variety of approaches to environmental protection, many of which have involved elements that first incentivized and later required the creation and maintenance of green infrastructure.

In addition to this, a series of German federal and state court rulings beginning in the 1970s have required increased transparency and equitable rate structures for stormwater services.⁴¹ As a result, the majority of German households are charged for stormwater services based on an estimate of the stormwater burden generated from their properties. This approach of individual parcel assessments (IPAs) differs from the approach used in the United States, where the same charges are levied on all parcels or all parcels of the same class (such as residential). Since IPAs in Germany are used to assess fees that relate directly to conditions present on specific parcels, and because land-use decisions (like paving a driveway or installing a green roof) have major impacts on the amount of stormwater leaving a property, this approach creates incentives for individuals to incorporate green infrastructure on their properties.⁴¹

Comparison with Green Infrastructure Practice in the United States

While there is interest in the multiple benefits of green infrastructure in the United States, green infrastructure techniques have gained recent attention in relation to stormwater management. Federal Clean Water Act programs require that local governments overhaul stormwater-management strategies to protect and improve surface-water quality.⁴² The Metropolitan Water Reclamation District of Greater Chicago, for instance, has already invested U.S.\$3.1 billion in a multiphase tunnel and reservoir plan to improve stormwater management.⁴³ To raise needed funds, the creation of stormwater utilities and the assessment of stormwater fees are becoming increasingly widespread. To date, however, the vast majority of U.S. cities have chosen to assess stormwater fees on a class basis; they assess the same fee to all parcels within a given class based on the average stormwater burden their property type contributes.⁴⁴ This methodology is used almost exclusively for residential parcels and greatly simplifies billing.

Transferable Lessons for Green Infrastructure in the United States

While the United States has focused attention on green infrastructure in relation to stormwater, most U.S. municipalities currently lack the kind of overlapping, reinforcing incentives and requirements that have led to the prominence of these techniques in Germany. This is particularly important given the multiple benefits provided by green infrastructure—such as stormwater management, air-quality improvements, and enhancement of urban quality of life.

Focusing on stormwater management specifically, however, there are further lessons that the United States could draw from German experience with parcel-level assessments, or IPAs. Specifically, this approach might improve watershed planning and stormwater management and address the public relations needs of cash-strapped water-management authorities in three ways: (1) data from IPAs could increase public awareness of human impacts on watersheds; (2) this detailed information could inform watershed planning; and (3) this data could be the basis of fee systems designed to create incentives for on-site stormwater management where cost effective.⁴¹

In Berlin, public participation in assessing IPAs is credited with helping the public understand the connections between land-use decisions on their own property and environmental problems in local lakes and rivers. IPAs also provide detailed spatial information about impervious surfaces and their connectedness to the storm sewer system. The latter can only be assessed through on-site surveys, and thus it is otherwise rarely available to engineers and planners. Since connected impervious surface coverage is such a key variable in estimating stormwater burden, this information could enhance watershed planning and the development of stormwater models designed to optimize the efficiency of existing systems.^{41,45}

Ascertaining each property's share of the stormwater burden effectively turns what is a diffuse, nonpoint pollution source into a point-source problem. Such a fee-assessment system makes it possible to reduce fees for parcels that manage stormwater with green infrastructure or other best practices. IPAs could, therefore, create a foundation for economic incentives, such as a fee-and-subsidy system or emissions trading, to encourage green infrastructure where it can cost-effectively manage stormwater.⁴⁶ A significant obstacle to this in the United States is the low rate currently charged for stormwater removal.⁴⁷ It could prove politically and legally difficult for U.S. stormwater utilities to charge fees high enough to serve as incentives for on-site stormwater management.⁴⁸

Implementing Sustainable Transportation

Governments at federal, state, and local levels in Germany determine the sustainability of the transportation system. Federal gasoline taxes, sales taxes, and regulations make automobile use and ownership expensive and encourage demand for less polluting and smaller cars. In 2008, sales taxes on automobiles in Germany were three times higher than in the United States, and gasoline taxes were nine times higher.^{49–53} However, higher gasoline taxes do not translate to higher household expenditures for transportation in Germany compared to the United States. Germans own fewer and more energy efficient cars and drive fewer miles than Americans. Thus, in 2008 transportation accounted for roughly 14 percent of household expenditures in Germany, compared to about 19 percent in the United States. The German federal government provides dedicated matching funds for investments in local public transportation. Flexible



Melissa Keeley

Potsdamer Platz is an office, entertainment, and retail center at the heart of Berlin, raised during World War II and then redeveloped after the reunification of east and west Berlin in 1990. This mixed-use site features an elaborate, naturalistic stormwater retention system designed to minimize the burden on the city's existing water infrastructure. The system incorporates green roofs (seen here) on most buildings in the complex to reduce stormwater runoff.

federal matching funds for local transportation improvements can also be used for local public transportation, walking,



Melissa Keeley

Stormwater runoff in Potsdamer Platz is collected in this pond. Vegetation on the banks of the pond and other treatments are used to purify and remove nutrients from the water, which is then reused in a grey water system for toilet flushing, irrigation, and fire systems within the complex.

and cycling projects.⁵⁴ German states distribute federal funds for regional rail systems and coordinate public transportation services statewide.⁵⁵ Many German states set minimum parking requirements for local developments. Federal and state governments provide the framework for more-sustainable transportation, but cities have played a crucial role in developing and implementing innovative policies (see Box).

The Freiburg Model of Transport Sustainability

Since the late 1960s, the city of Freiburg (population 220,000) has been at the forefront of promoting sustainable transport.^{1,2} Since then, the number of trips by bicycle has tripled, transit ridership has doubled, and the share of trips by car has fallen from 38 to 32 percent. Since the early 1990s, the level of motorization has stagnated and per capita CO₂ emissions from transportation have fallen, in spite of strong economic and population growth. Up to the late 1960s, Freiburg promoted greenfield development, widened streets, abandoned trolley lines, and built car parking lots. Motorization increased rapidly, transit ridership plummeted, and the city was sprawling. Air pollution, traffic fatalities, and traffic congestion caused by cars and other environmental concerns shifted public opinion away from automobile-centered growth.² Freiburg achieved a more sustainable transportation system by (1) successfully integrating land-use and transportation planning, (2) coordinating and integrating public transportation regionally, (3) promoting bicycling, (4) restricting automobile use, and (5) encouraging citizen participation throughout the process.^{2,3}

Integrating Transportation and Land-Use Planning

Even though Freiburg started implementing sustainable transportation policies in the early 1970s—such as creating pedestrian zones in the downtown area—there was no formal link between land use and transportation planning. The two have become more formally coordinated since then. The comprehensive transportation plan of 1979 called for explicit integration of both planning sectors. The land-use plan of 1981 prescribed that new development was to be concentrated along public transportation corridors. In 2006, two-thirds of Freiburg's residents' jobs were located within a quarter mile of a light-rail stop.²

Freiburg's most recent land-use and transportation plans in 2008 were developed simultaneously and are fully integrated. Both reiterate the goals of reducing car use and favor central mixed-use development over settlements on the suburban fringe. Vauban and Rieselfeld, two new inner suburbs built around light-rail line extensions, are good examples for today's complete integration of transportation and land-use planning. Both communities are compactly laid out and mix residential, commercial, educational, and recreational land uses. Car access and parking are limited, and streets are traffic-calmed with speed limits of 30 kilometers per hour, or even 7 kilometers per hour, to give priority to pedestrians, cyclists, and playing children.²

Expanding and Coordinating Public Transportation Services

In the early 1970s, the city decided to expand its public transportation network, but it took until 1983 before the first new light-rail line was added to the existing 14 kilometers of track. Since then, Freiburg has opened four new lines for a total of 36.4 kilometers in 2008, and the amount of light-rail service has tripled. In 1984, Freiburg's public transportation system offered Germany's first monthly ticket—transferable to other users.⁴ In 1991, the geographic coverage of the ticket was expanded to include the city and two adjacent counties. Services, fares, subsidies, and timetables for bus and rail operators are coordinated regionally. The monthly ticket offers unlimited public transportation travel within the entire region for about U.S.\$60. Over 90 percent of passengers have monthly or annual tickets.^{2,3} Due to the high demand, Freiburg's transit system has become one of the most financially efficient in Germany—requiring operating subsidies of only 10 percent (compared to 65 percent for public transit systems in the United States).⁴

Making Cycling a Viable Transportation Alternative for All Trips

Separate bike infrastructure and cyclist-friendly streets make the bicycle a feasible option for all trips and all destinations in Freiburg. Since the early 1970s, Freiburg has expanded its network of separate bike paths and lanes fivefold to 160 kilometers in 2007. This network is complemented by bike routes through forests, traffic-calmed roads, and bicycle streets. Additionally, the city has traffic-calmed almost all residential streets. In 2008, nine out of ten Freiburgians lived on streets with speed limits of 30 kilometers per hour or less. Slow automobile speeds encourage more cycling and make it safer. The total number of bike trips in Freiburg has nearly tripled since 1976—amounting to almost one bike trip per inhabitant per day in 2007.²

The city requires bike parking in all new buildings with two or more apartments, as well as in schools, universities, and businesses. Between 1987 and 2009, the number of bike parking spaces in downtown and at transit stops increased significantly—including a major bike parking garage at the main train station, with space for 1,000 bikes.²

Restricting Automobile Use

Many of the policies that promote public transportation, bicycling, and walking involve restrictions on car use—such as car-free zones and traffic-calmed neighborhoods.^{2,5} Freiburg's official goal is to reduce car use wherever practical and to accommodate automobile trips that cannot be made by any other mode. Thus, the city combines disincentives to use cars in the town center and residential neighborhoods with improvement of arterials in various ways (such as widening) to increase their carrying capacity. Freiburg's parking policy is designed to make car use less convenient and more expensive. Parking garages are relegated to the periphery of the city center, which was converted to pedestrian use in the early 1970s. In many residential neighborhoods, parking is reserved for residents only and requires a special permit. On-street parking in commercial areas of the city becomes more expensive with proximity to the center.^{2,5}

Citizen Involvement

Since the 1970s, citizen participation has been a key aspect of transportation and land-use planning in Freiburg. For example, citizen groups worked with the city administration to redevelop Vauban into an environmentally friendly car-free neighborhood.² Moreover, Freiburg's latest land-use plan has been developed with sustained input from 900 citizens, 19 neighboring municipalities, and 12 special-purpose governments in the region. Citizen involvement and public discourse has kept the environmental benefits and sustainability of the transportation system in the news for decades in Freiburg. Over time, public opinion has become more and more supportive of sustainable environmental policies. Even politicians from the conservative party have accepted restrictions on car use and have promoted public transportation, bicycling, and walking as alternatives.

Lessons Learned from Freiburg

It is inappropriate to assume that Freiburg's experience can be copied wholesale in the U.S. However, there are many lessons from Freiburg for U.S. cities that intend to become more sustainable.^{2,5}

First, Freiburg implemented most of its policies in stages, often choosing projects everybody agreed upon first. Residential traffic calming was initially implemented in neighborhoods whose residents complained most about the negative impacts of car travel. Successful implementation in one neighborhood encouraged other areas of the city to request traffic calming as well.

Second, Freiburg phased in and adjusted its policies and goals gradually. The initial decision to stop tearing out the trolley tracks was made in the late 1960s. In the early 1970s, the city council approved the extension of the light-rail system, which finally opened in 1983. Once the expansion proved successful, more light-rail lines followed.

Third, Freiburg has simultaneously made public transportation, cycling, and walking viable alternatives to the automobile, while increasing the cost of car travel. Improving quality and level of service for alternative modes of transportation made car-restrictive measures politically acceptable.

Fourth, citizen participation has been a key aspect of transportation and land-use planning in Freiburg. For example, citizen groups worked with the city administration to redevelop Vauban into an environmentally friendly car-free neighborhood.

Lastly, changing transportation, land-use systems, and travel behavior in Freiburg took almost 40 years. Planners in the United States should curb their expectations for quick success. Clearly, some policies can be implemented quickly, but changes in travel behavior and the development of a more sustainable transportation system take much longer.

References

1. Please see the sources cited in the four publications listed below for more detailed references and additional information for this case study.
2. Buehler, R & Pucher, J. Sustainable transport in Freiburg: lessons from Germany's environmental capital. *International Journal of Sustainable Transportation* 5, 43–70 (2011).
3. Buehler, R. Transport policies, automobile use, and sustainable transportation: a comparison of Germany and the USA. *Journal of Planning Education and Research* 30, 76–93 (2010).
4. Buehler, R & Pucher, J. Making public transport financially sustainable. *Transport Policy* 18(1), 128-136 (2011).
5. Buehler, R, Pucher, J & Kunert, U. Making transportation sustainable: insights from Germany (The Brookings Institution, Washington, DC, 2009).
www.brookings.edu/reports/2009/~//media/Files/rc/reports/2009/0416_german....

Sustainability Lessons for the United States

Implementing German-style policies in the United States requires careful consideration of the political, cultural, and institutional context. For example, legal and political barriers could hamper a transfer of German policies to the United States. Nevertheless, our case studies of energy, urban infrastructure, and transportation provide some overall lessons that could help encourage development of sustainability policies in the United States.

First, start small and implement policies in stages. Many sustainability policies in Germany were first implemented at a small geographic scale or with a small scope and were expanded in stages over time. Small-scale pilot projects allow policymakers to experiment and the public to experience a real-life example of the proposed program. Unsuccessful

policy makers to experiment and the public to experience a real-life example of the proposed program. Unsuccessful projects can be discontinued and successful programs can be expanded. For example, many German cities initially implemented traffic-calming technologies in those neighborhoods where residents complained most about traffic safety, noise, and air pollution from car travel. Successful implementation of a pilot project in one neighborhood led other neighborhoods to demand traffic calming as well. This approach can also work at other scales and in other sectors. For example, the German Renewable Energy Sources Act initially covered only very basic technologies, but it was extended over time and rewarded innovations and new approaches. To some extent the United States is using this approach already, as witnessed by the creation of pedestrian zones in New York City's Times Square or the new bike lanes on Pennsylvania Avenue in Washington, DC. On the federal level, however, the U.S. Congress does not have a consistent history of passing incremental improvements to energy policy or climate legislation.

Another aspect of staged implementation is political acceptability. For example, the German Ecological Tax Reform Act, which increased taxation on energy to reduce social security taxes, was implemented in stages, with taxes increasing annually over a period of five years. Consolidating the staged tax increases into one large tax hike would not have been politically feasible. Staged implementation, the five-year time horizon, and lower social security taxes enabled citizens to adjust to the new taxes. Similarly, many policies encouraging green infrastructure on private properties began as financial incentives and only later were replaced by requirements, once there was greater acceptance and experience with these techniques.

Second, there are no silver bullets. Policies should be coordinated across sectors and levels of government to achieve maximum effectiveness. Despite the high public visibility of flagship projects like the Ecological Tax Reform Act, no silver bullet has proven to be the single factor for successful results. The case studies show that individual policies were integrated into a larger policy framework. At its best, this framework is comprehensive and long-term oriented. For example, in transportation, the German federal government increased taxation on gasoline, while local governments improved conditions for walking, cycling, and public transportation—thus offering a viable alternative to the car. This approach increased political acceptability with the public, since drivers had a choice to continue driving at higher cost or to shift modes of transportation.



Ralph Buehler

Pedestrians and light rail in Freiburg's car-free zone in the city center.

In Germany, green infrastructure has been incentivized and in some cases required by a suite of overlapping programs. Significantly, these initiatives come from various governmental levels and sectors and were created because of different benefits provided by green infrastructure—such as stormwater management, air-quality improvements, and urban quality of life. It is this suite of policies as a whole that has moved green infrastructure into the German mainstream. Energy policy is another good example of coordinated decision making and planning: Germany's policy portfolio comprises more than 30 legislative measures that address all aspects of energy sustainability, with binding long-term targets guiding implementation efforts and the necessary review of policies at regular intervals. In the United States, by contrast, short-term incentives, fragmented regulations, and a lack of planning certainty—in the absence of a binding policy framework—have dampened private-sector investment and technology deployment.

Third, foster citizen participation and communicate policies effectively. Policies that affect people's everyday lives have to be developed with active citizen participation. Citizen input reduces potential legal challenges, increases public acceptance, and has the potential to improve projects and outcomes. Public participation in assessing parcel-level charges and new stormwater fees in Berlin helped the public to understand how their properties contribute to environmental problems. Further, individuals can take steps to reduce fees by integrating green infrastructure techniques on their properties. The initial draft of the city of Freiburg's land-use plan was rejected by the citizens as not being progressive enough (see Box). The second draft was developed with the ongoing participation of 900 residents. The public sector has to effectively communicate the intentions of policy. This often involves political trade-offs. For example, Germany's Ecological Tax Reform Act increased the cost of energy but at the same time reduced social security taxes. While many citizens agreed to increase taxation on energy, the reduction in social security taxes was also very important.

Fourth, find innovative solutions and embrace bipartisanship. The implementation of several of the highlighted policies came with strong political controversy in Germany. However, the policies survived because, over time, parties across the political spectrum benefited from them or could not afford reversing them. For example, the Renewable Energy Sources Act was supported by both the political left and right because both the progressive renewable-energy industry and the conservative German farm community benefited from its implementation. Before and during the introduction of the Ecological Tax Reform Act, Germany's center-right parties opposed the reform and promised to roll it back once they were in power again. However, after winning elections in 2005, the conservatives found it impossible to forfeit the robust tax revenue generated by the reform.

References

1. The White House. Remarks by the president in State of Union Address [online] (2011). www.whitehouse.gov/the-press-office/2011/01/25/remarks-president-state-u...

2. Hanzlmann, T. *Waldedf#brennholz*. *Handel Business Magazine* 20(12): 44-48 (2010).

2. Henzemann, I. Weirmarktunrer beim Umweltschutz. *Harvard Business Manager* 30(12), 44–49 (2010).
3. Theil, S. No country is more 'green by design.' *Newsweek* [online] (2008). www.newsweek.com/id/143679.
4. Federal Ministry of Economics and Technology & Federal Ministry for the Environment, Nature Conservation and Nuclear Safety. *Energy Concept for an Environmentally Sound, Reliable and Affordable Energy Supply* [online] (2010). www.bmu.de/files/english/pdf/application/pdf/energiekonzept_bundesregier...
5. Määttä, K & Mehling, M in *Realising the Paradigm Shift towards Energy Sustainability: Climate Change, Technological Innovation, and the Challenge of an Optimal Instrument Mix* (Rodi, M, ed), 49–64 (Lexion, Berlin, 2010).
6. Mehling, M. The ecological tax reform in Germany. *Tax Notes International* 26, 871–878 (2000).
7. Mehling, M in *Energy: A Tax Analysts Special Supplement* (Almeras, J, ed), 132–135 (Tax Analysts, Arlington, VA, 2006).
8. Ludewig, D et al. *Greening the Budget: Pricing Carbon and Cutting Energy Subsidies to Reduce the Financial Deficit in Germany*, 15 (Heinrich Böll Stiftung, Washington, DC, 2010).
9. Kohlhaas, M. *Gesamtwirtschaftliche Effekte der ökologischen Steuerreform*, 14 (DIW, Berlin, 2005).
10. Knigge, M & Görlach, B. *Die Ökologische Steuerreform—Auswirkungen auf Umwelt, Beschäftigung und Innovation*, 5 (Ecologic, Berlin, 2005).
11. Umweltbundesamt. *Quantifizierung der Effekte der Ökologischen Steuerreform auf Umwelt, Beschäftigung und Innovation*, 2 (UBA, Berlin, 2004).
12. Vedder, H. The Treaty of Lisbon and European environmental law and policy. *Journal of Environmental Law* 22(2), 285–299 (2010).
13. Directive 2009/28/EC of the European Parliament and of the Council [online] (April 23, 2009). <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:140:0016...>
14. German Federal Ministry of the Environment, Nature Conservation, and Nuclear Safety. *Development of Renewable Energy Sources in Germany 2009* [online] (March 2010). www.erneuerbare-energien.de/files/pdfs/allgemein/application/pdf/ee_in_d...
15. German Federal Ministry of the Environment, Nature Conservation, and Nuclear Safety. Press release no. 116/10 [online] (August 4, 2010). www.bmu.de/english/current_press_releases/pm/46293.php.
16. German Federal Ministry of the Environment, Nature Conservation, and Nuclear Safety. *Nationaler Aktionsplan fuer Erneuerbare Energien* [online] (August 4, 2010). www.bmu.de/files/pdfs/allgemein/application/pdf/nationaler_aktionsplan_e... English summary at www.bmu.de/english/renewable_energy/downloads/doc/46291.php.
17. Edler, D & O'Sullivan, M. Erneuerbare Energien—ein Wachstumsmarkt schafft Beschäftigung in Deutschland. *Wochebericht des DIW Berlin*, 41/2010 [online] (2010). www.diw.de/sixcms/detail.php?id=diw_01.c.362416.de.
18. DEBRIV. Der Wirtschaftsfaktor Braunkohle. Ausgabe 04/2010 [online] (2010). www.braunkohle-wissen.de/#arbeitspl%20.
19. German Federal Ministry of the Environment, Nature Conservation, and Nuclear Safety. Renewable Energy Sources Act (EEG) 2009 [online] (2010). www.erneuerbare-energien.de/inhalt/42934/20026.
20. German Federal Ministry of the Environment, Nature Conservation, and Nuclear Safety. *Nationaler Aktionsplan für Erneuerbare Energien* [online] (August 4, 2010). www.bmu.de/files/pdfs/allgemein/application/pdf/nationaler_aktionsplan_e... English summary at www.bmu.de/english/renewable_energy/downloads/doc/46291.php.
21. Deutsche Bank Climate Change Advisors (DBCCA). *Creating Jobs and Growth: The German Green Experience* [online] (September 14, 2009). www.dbcca.com/dbcca/EN_media/DBCCA_Creating_Jobs_and_Growth_The_German_...
22. Wolf-Peter Schill, W-P, Diekmann, J & Kemfert, C. Energy and climate policy: USA continues to trail behind, despite positive change. *DIW Berlin Weekly Report*, 5/2010 [online] (January 21, 2010). www.diw.de/sixcms/detail.php?id=diw_01.c.346123.de.
23. Global Wind Energy Council. Wind is a global power source [online] (2010). www.gwec.net/index.php?id=13&L=0.
24. U.S. Energy Information Agency. *Annual Energy Review 2009*, table 1.3 (U.S. Energy Information Agency, Washington, DC, 2009).
25. U.S. Department of Energy. Database of State Incentives for Renewable and Efficiency [online]. www.dsireusa.org.
26. Diekmann, J. Renewable energy in Europe: strong political will required for ambitious goals. *DIW Berlin Weekly Report*, 36/2009 (December 18, 2009).
27. Renewable Energy Policy Network for the 21st Century (REN21). *Renewables 2010 Global Status Report*, 11 (REN21 Secretariat, Paris, 2010). www.ren21.net/Portals/97/documents/GSR/REN21_GSR_2010_full_revised%20Sep...
28. National Renewable Energy Laboratory. *Renewable Energy Prices in State-Level Feed-In Tariffs: Federal Law Constraints and Possible Solutions*, NREL Report TP-6A2-47408 [online] (2010). www.nrel.gov/analysis/pdfs/47408.pdf.
29. Woerlen, C. *Clean Energy Jobs for the U.S. Midwest: Lessons Learned from the German Success Story of Low Carbon Growth* [online] (Heinrich Böll Stiftung, Washington, DC, 2010). <http://boell.org/web/139-658.html>.
30. Hey, C in *The New Climate Policies of the European Union* (Oberthur, S & Pallemmaerts, M, eds), The German paradox: climate leader and green car laggard, 211 (Institute for European Studies, Brussels, 2010).
31. Köhler, M & Keeley, M in *Green Roofs: Ecological Design and Construction* (EarthPledge Foundation, ed), The green roof tradition in Germany: the example of Berlin (Schiffer, New York, 2005).
32. Watchel, J. Take it from the top: storm water management, green roof style. *BioCycle*, 42–46 (2007).
33. Mentens, J, Raes, D & Hermy, M. Green roofs as a tool for solving the rainwater runoff problem in the urbanized 21st century. *Landscape and Urban Planning* 77, 217–226 (2006).
34. Teemusk, A & Mander, U. Temperature regime of planted roofs compared with conventional roofing systems. *Ecological Engineering* 36, 91–95 (2010).
35. Saiz, S, Kennedy, C, Bass, B & Pressnail, K. Comparative life cycle assessment of standard and green roofs. *Environmental Science and Technology* 40(13), 4312–4316 (2006).
36. Lükenga, W & Wessels, K. Oberflächentemperaturen von Dachflächen. *Stadt + Grün* 6/2001, 399–403 (2001).
37. Currie, B & Bass, B. Estimates of air pollution mitigation with green plants and green roofs using the UFORE model. *Urban Ecosystems* 11, 409–422 (2008).
38. Oberndorfer, E et al. Green roofs as urban ecosystems: ecological structures, functions, and services. *Bioscience* 57, 823–833 (2007).
39. Kealey, M. *Green Roofs Incentives: Tried and True Techniques from Europe*. Proceedings from the 2nd Annual

39. Keeley, M. *Green Roofs Incentives: How and How Techniques from Europe*. Proceedings from the 2nd Annual Green Roofs for Healthy Cities Conference [online] (2004). www.greenroofs.ca/grhcc.
40. Keeley, M. The green area ratio: site-scale urban environmental planning. *Journal of Environmental Planning and Management* (forthcoming).
41. Keeley, M. Using individual parcel assessments to improve stormwater management. *Journal of the American Planning Association* 73(2), 149–160 (2007).
42. National Research Council. *Urban Stormwater Management in the United States* (The National Academies Press, Washington, DC, 2008) www.epa.gov/hpdes/pubs/nrc_stormwaterreport.pdf.
43. Garcia, MA & Schmidt, AR. Applied research: tunnel and reservoir plan [online] (n.d.). <http://mchl.uiuc.edu/applied-research/environmental-hydraulics/tarp>.
44. Busco, D & Lindsey, G. Designing stormwater user fees: issues and options. *Stormwater* 2(7), 42–44 (November/December 2001).
45. Perez-Pedini, C, Linbrunner, JF & Vogel, RM. Optimal location of infiltration-based best management practices for storm water management. *Journal of Water Resources Planning and Management* 131(6), 441–448 (November/December 2005).
46. Thurston, HW, Goddard, HC, Szlag, D & Lemberg, B. Controlling storm-water runoff with tradable allowances for impervious surfaces. *Journal of Water Resources Planning and Management* 129(5), 409–418 (September/October 2003).
47. Kaspersen, J. The stormwater utility, will it work for your community? *Stormwater* 1(1), 22–28 [online] (November/December 2000). www.forester.net/sw_0011_utility.html.
48. Parikh, P, Taylor, MA, Hoagland, T, Thurston, H & Shuster, W. Application of market mechanisms and incentives to reduce stormwater runoff: an integrated hydrologic, economic and legal approach. *Environmental Science and Policy* 8(2), 133–144 (2005).
49. International Energy Agency (IEA). *Energy Prices and Taxes* (IEA, New York, 2008).
50. Bundesministerium der Finanzen [German Federal Ministry of Finance] (BMF). *Mehrwertsteuer* [Value-added tax] (BMF, Berlin, 2008).
51. Buehler, R & Pucher, J. Sustainable transport in Freiburg: lessons from Germany's environmental capital. *International Journal of Sustainable Transportation* 5, 43–70 (2011).
52. Buehler, R. Transport policies, automobile use, and sustainable transportation: a comparison of Germany and the USA. *Journal of Planning Education and Research* 30, 76–93 (2010).
53. Federation of Tax Administrators. State Sales Taxes on Vehicle Purchases [online] (2006). www.taxadmin.org.
54. BMVBS. *Bericht fuer das Jahr 2005 ueber die Finanzhilfen des Bundes zur Verbesserung der Verkehrsverhaeltnisse der Gemeinden nach dem Gemeindeverkehrsfinanzierungsgesetz* [Federal Subsidies for Local Transportation Projects] (German Federal Ministry of Transportation and Urban Development, Berlin, 2005).
55. Buehler, R, Pucher, J & Kunert, U. *Making Transportation Sustainable: Insights from Germany* (The Brookings Institution, Washington, DC, 2009). www.brookings.edu/reports/2009/~media/Files/rc/reports/2009/0416_german...



Ralph Buehler Assistant Professor in urban affairs and planning at Virginia Tech



Arne Jungjohann Director for the Environment and Global Dialogue Program of the Heinrich Böll Foundation in Washington, DC



Melissa Keeley Assistant Professor in geography and public policy and public administration at George Washington University



Michael Mehling President of the Ecologic Institute; Adjunct Professor at Georgetown University

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