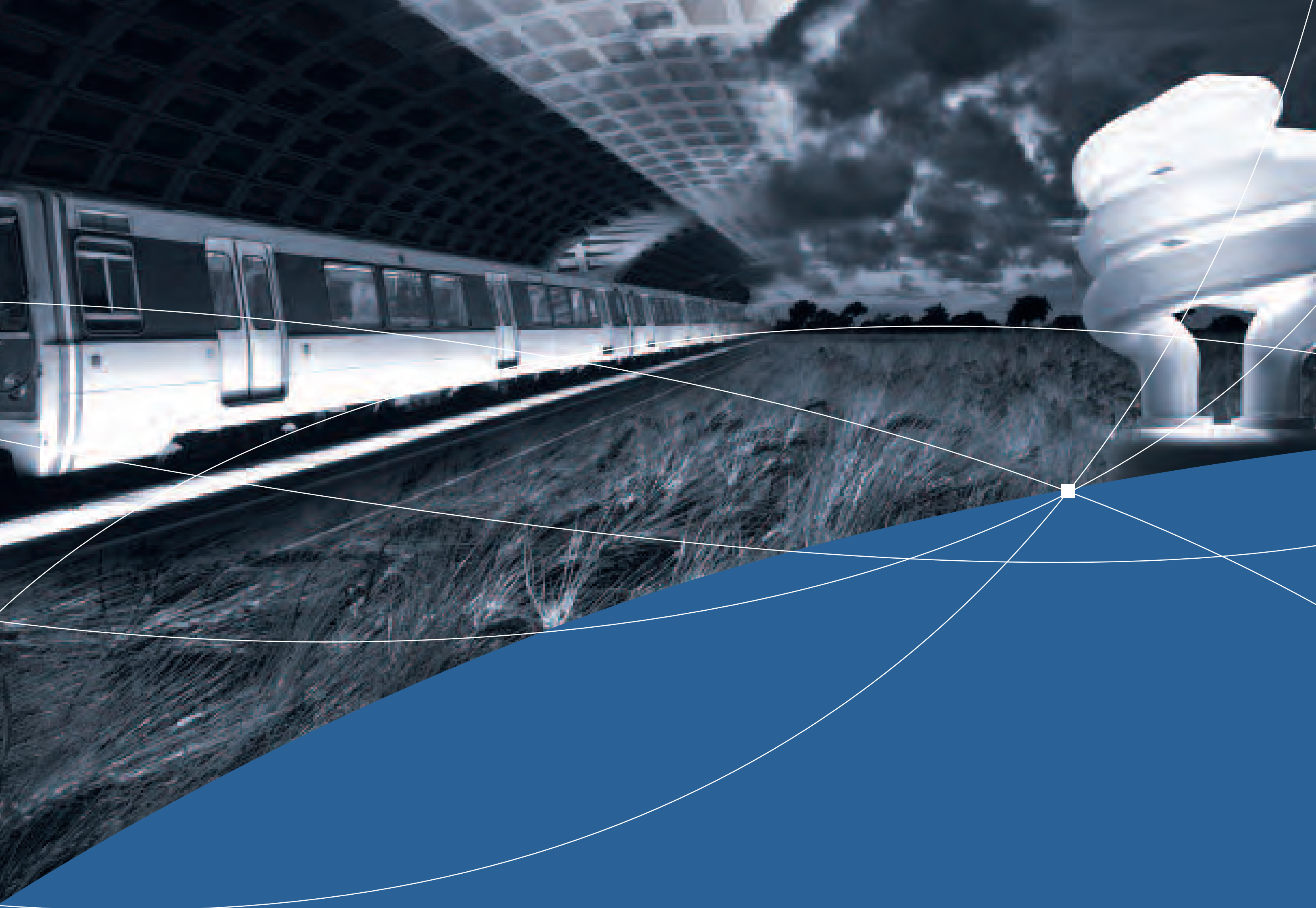

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AICGSPOLICYREPORT

PROMOTING ENERGY INNOVATION AND INVESTMENT THROUGH TRANSATLANTIC TRANSFER OF COMMUNITY ENERGY POLICIES

Dale Medearis
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AMERICAN INSTITUTE FOR CONTEMPORARY GERMAN STUDIES THE JOHNS HOPKINS UNIVERSITY

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FOREWORD

In the twenty-first century, the need for energy sustainability is clear. Countries can no longer afford to consume the same types of energy as in the past, either environmentally or economically, and are moving toward implementing policies and technologies for the future. As two federal states, the U.S. and Germany can use regional climate and energy policies to implement more efficient energy usage in the community, a practice known as Community Energy Planning.

A Policy Report with far-reaching suggestions for policymakers, this study looks to the European Union and Germany to draw lessons about community energy planning at the national and sub-national levels that can be transferred to the U.S. The authors delve into questions such as, how does the integration of land-use and transportation planning policies at the regional and local level in the U.S. compare with those in Germany? Are these policies able to effect a meaningful emissions reduction? How do the development of finance mechanisms and performance measures for energy efficient building construction, retrofits, and renewable energy applications differ in the U.S. and Germany? How are they similar? Looking at the German examples of Stuttgart and Mannheim for community energy planning (large-scale geographically defined projects that blend transit-oriented development, building retrofits, renewable energy, co-generation, district heating and cooling, and quantitative performance measures), the authors then analyze what aspects of these German cities' success stories can be transferred to the U.S. by regional community actors.

This publication is an example of AICGS' commitment to furthering the transatlantic discussion on the global issues of climate change and energy sustainability and builds on previous projects on those topics. AICGS is grateful to the authors for their insights, the *Daimler-Fonds im Stifterverband die Deutsche Wissenschaft* for its generous support of this publication, and to Jessica Riester for her editorial work.

Best regards,

Jack Janes
Executive Director

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Dr. Dale Medearis is a senior environmental planner for the Northern Virginia Regional Commission. He recently returned from an 8-month sabbatical at the Free University of Berlin's Environmental Policy Research Center to research and write about the transfer of local energy and climate policies from German cities to the U.S. He leads the NVRC's regional climate and energy programs and manages NVRC's international environmental partnerships through the European Network of Metropolitan Areas and Regions (METREX). Prior to working for NVRC, Medearis spent 20 years at the Office of International Affairs, U.S. Environmental Protection Agency, Washington, as the program manager for Western Europe and urban environmental programs. He was the Vice-chair of the OECD Territorial Development Committee and Chairman of the OECD Working Group on Urban Affairs. Medearis has been awarded fellowships to study urban and environmental planning in Europe from the German Academic Exchange Council, the FU Berlin, the Alexander Von Humboldt Foundation, the Fulbright Commission, the European Union, and the American Council on Germany. He has a Ph.D. in environmental design and planning from Virginia Tech University, an M.S. in Cartographic and Geographic Science from George Mason University, an MGA in Government from the University of Pennsylvania, and a BA in International Relations from the University of Redlands.

01

INTRODUCTION

INTRODUCTION[1]

As consumption of conventional fossil fuels and emissions of greenhouse gas emissions in the United States continue to rise, current sectoral energy and urban development paradigms are proving insufficient.[2] The U.S. continues to use substantially more energy than other major industrial countries of the world such as Germany, where consumption of primary energy per capita is 177 million British Thermal Units (BTUs) compared to 276 million BTUs in the United States.[3] The U.S. uses 40 percent more energy for every dollar of GDP than Germany and national energy costs exceed $1 trillion per year.[4] In the context of the $3.75 trillion transatlantic economic relationship, the high consumption of energy per dollar of GDP has the potential to lead to substantial disadvantages of U.S. economic competitiveness.[5] The extent to which energy planning at the U.S. national or sub-national levels occurs, it is common to observe the development of aspirational goals as the indicators of progress rather than the development and attainment of actionable energy cost, reliability, efficiency, and greenhouse gas reduction targets that are quantifiable, implementable, and verifiable. Wheeler assessed the climate and energy plans of twenty-nine U.S. states, including the goals and measures of these plans.[6] He observed that the majority of efforts to reduce emissions were voluntary-based, were seldom implemented, and lacked dedicated resources for the necessary large-scale transformation of the energy supply, building, and transportation sectors.

By most energy and environmental performance measures, Germany leads the United States. Between 1990 and 2007, Germany's 25 percent energy efficiency gains outpaced economic growth and energy consumption per capita is no higher today than in 1990.[7] Between 1990 and 2007, Germany increased production of electricity from renewable sources (excluding heavy hydro) from less than 3 percent to over 12 percent. Since 1990, Germany has cut total emissions of greenhouse gases by 8 percent below 1990 base-year levels and currently emits approximately 10 tons of CO_2 per person compared to the over 19 tons per person in the United States.[8] It is now national policy in Germany to cut emissions of greenhouse gas emissions 40 percent by 2020 from 1990 levels and to increase total renewable energy consumption from 4.2 percent in 2007 to at least 10 percent by 2020, and perhaps to 50 percent by 2050. Moreover, via the Meseberg Summit, in 2007 Germany firmly ensconced heat recovery and transportation as national strategic priorities.

As the U.S. works at all levels of government to develop meaningful policies for energy and climate, it stands to benefit by drawing lessons from the thirty years of Germany's (and other European Union countries') pioneering experience with energy management. Since the Cold War and the energy crises of the 1960s and 1970s, Germany has successfully framed its energy security and environmental challenges by implementing policies that integrate energy efficiency, heat recovery, renewable energies, energy distribution, transportation, and land-use development—a framework that in North America is becoming referred to as Community Energy Planning (CEP). At the national level, Germany has incrementally improved energy efficiency codes for new and existing homes and buildings; established feed-in tariffs for biomass, solar, wind, and other renewable energies; incentivized district energy, cogeneration, combined heat, and power from multiple fuels; and integrated transportation, spatial, and urban development planning policies. At the sub-national level, cities such as Hamburg, Berlin, Mannheim, and Stuttgart have applied land-use and transportation policies that have successfully promoted density, transportation options, and district heating and cooling on large-scale (i.e., hundreds of hectares/ acres) development projects. In the U.S., over 70 percent of all energy is consumed in urban areas, underlining the relevance of successful city-wide approaches.[9]

A vital lesson for U.S. sustainable energy policies and innovations is to be observed in Germany's experiences with the development of systemic, integrated, long-term approaches to multiple energy and urban development policies aimed at supply security, technical flexibility, affordability, and environmental performance. The energy future of both countries rests less in the development and support of the "magic bullet" and a few specific technologies or singular policies. Rather, the energy future rests more on integrated and multi-dimensional perspectives. Energy sustainability will be driven by balanced approaches that maximize energy efficiencies of existing systems such as homes and buildings, district heating and cooling, and transit-oriented urban development patterns, complemented by incremental and targeted applications and efficient distribution of new technologies such as low-impact buildings and vehicles, large-scale and micro-cogeneration, and renewable energy sources such as solar photovoltaic and wind. These observations are supported by McKinsey and Company,[10] which noted that Germany has the ability to reduce greenhouse gases by as much as 30 percent from 1990 levels by 2020, without curbing economic growth, lifestyle changes, or lowering levels of comfort by extending, bundling, and maximizing existing energy systems. Matthes and Perelman add that the technologies to promote similarly reasonable emissions reductions of greenhouse gases are already available—particularly in the realm of energy efficiency (such as insulation, modern heating equipments, electronic appliances, combined cycle power plants, and centralized and distributed cogeneration).[11]

Cities such as Freiburg and Stuttgart have justifiably captured international attention for their pioneering work with renewable energy applications such as solar photovoltaic or infrastructure for fuel cells. But it is equally noteworthy to highlight, especially for the U.S., the experiences of Mannheim—a heavily industrialized city that emits less than approximately 6 tons of CO_2 per person, but derives 90 percent of its primary energy from bituminous coal.[12]

Despite the successful results of Germany's experiences with energy and climate innovations, little has been done to formally review and analyze the relevance of Germany's experiences for the United States—especially at the regional and municipal levels. Efforts to transfer and exchange energy-related and urban development policies have traditionally lacked problem-focused and goal-oriented contexts. Analysis of energy and other environmental innovations considered for import from abroad has lacked proper background about the framework in which countries such as Germany's energy policies have emerged. Details about the performance, and most critically, an analysis about what possibly can transfer and be applied in the United States given the extensive political, environmental, and institutional differences between both countries, are too frequently lacking. This lack of formal analysis and reasoned assessment of what can be adopted into a uniquely U.S. context is especially pronounced at the local level. As a result, international work in general and work to harvest lessons from abroad into the U.S. in particular is often perceived as irrelevant or sometimes wasteful.[13]

This paper endeavors to address the inter-related challenges of:

- Identifying and analyzing policies and practices that support sustainable energy innovations and efficiencies via community energy planning; and

- Formalizing the transfer and application of those energy innovations from Germany to the United States.

This Policy Report will describe the basic attributes and typology of community energy planning; summarize the relevant European Union-level, German national and sub-national policy contexts in which community energy planning evolved; and review two best practices community energy planning programs, and related "neighborhood scale projects" from Germany and the frameworks in which they evolved as well as the performance indicators used to frame assessment of success.

This paper then takes the unusual precedent of prospectively evaluating the relevant lessons and innovations about German community energy planning practices and their potential for application in the United States—specifically to Northern Virginia. By developing this information framework, we endeavor to address what Wolman has characterized as the information "Black Box" affecting policy transfer—the assessment of what can transfer and under what conditions.[14] The expectation is that policymakers equipped with this assessment of community energy planning, including knowledge about the origins and performance of German community energy policy models, will undertake more "reasoned consideration" about what can or should be adopted in the U.S. over the short and long terms.[15]

Methods and Data

Two "embedded" case studies supported by published books, journals, articles, and official governmental reports on energy efficiency, land-use, transportation, renewable energy, and building policies in Germany and the United States form the methodology for this paper. The case studies also are supported by semi-structured interviews with officials and practitioners from the selected German case studies. Case study methodology is selected because of its firm standing as the standard for assessing cross-national urban and environmental policy transfer.[16] Past and current comparative cross-national urban planning and environmental research encourages "conceptual equivalence" and similarity between study objects in order to encourage validity and avoid irrelevant analysis.[17] Germany was selected because of its strong historical precedents with exporting urban planning and environmental policies to the United States and the relatively comparable total energy use in both countries.[18]

Germany also was selected to give a critical perspective of U.S. community energy planning given the shared high-level focus among sub-national authorities on energy and climate change in both countries.[19] The community energy plans in the Stuttgart and Mannheim regions match many of the environmental, economic, and spatial attributes at existing large-scale urban regeneration projects in Northern Virginia, where community energy planning efforts have been started (specifically in Loudoun and Arlington counties). The community energy planning efforts in Stuttgart and Mannheim also were selected for their strong potential for replication in other parts of the U.S.

This paper makes no assumptions that the transfer of community energy planning from Germany can be, or should be, completely copied or replicated in the U.S. It is the intent of this paper to make recommendations and measures toward incremental change and piecemeal adoption that are fully within the existing authority of local jurisdictions in Northern Virginia. The content of the analysis of transfer to Northern Virginia is framed around the community energy planning typology described in section three of this paper. Quantitative benchmarks for this analysis draw from the two landmark community-wide energy planning efforts underway in Northern Virginia.

02

U.S. NATIONAL AND SUB-NATIONAL ENERGY AND CLIMATE CHALLENGES

ASSESSMENT OF U.S. NATIONAL AND SUB-NATIONAL ENERGY AND CLIMATE CHALLENGES

There are a number of energy and climate statistics that indicate community energy planning is a high priority for the U.S. Most current energy consumption and supply indicators suggest that under business-as-usual scenarios the U.S. will have difficulty balancing economic and demographic growth, energy security, and greenhouse gas reductions. By international benchmarks, the U.S. performs poorly in maximizing energy and fuel efficiency of the built (or urban) environment, in promoting and implementing clean and renewable energy supply, and in adopting more efficient transportation alternatives. In the U.S., approximately 92 percent of electricity comes from thermal (steam) generation, which is characterized by high conversion losses and inefficiencies of up to 69 percent.[20] Fewer than 3 percent of all trips in the U.S. are undertaken by bike, foot, or public transit.[21] In Germany the average number of trips on bike, foot, or transit is higher than 10 percent. Less than 7 percent of all commercial energy in the U.S. emanates from wind, biomass, or solar photovoltaic, compared to more than 10 percent in Germany. Moreover, the U.S. has transitioned only modestly in its dependence on fossil fuels from 93 percent in 1973 to 85 percent in 2007. Oil alone still contributes to over 40 percent of total energy in the U.S.[22]

There are multiple trends at the regional level in the U.S., such as Washington, DC, that mirror national energy challenges and will become key drivers of energy planning over the next thirty years. Over 1.5 million people are expected to move to the greater Washington, DC metropolitan region between 2010 and 2030, placing exceptional demands on housing and mobility. The energy sector in the Washington, DC area constitutes over 66 percent of the region's greenhouse gas emissions. The residential sector alone accounts for 33 percent of total energy demand in the region. The Washington Council of Governments has estimated that under current and anticipated growth scenarios, energy consumption will rise by 33 percent by 2010 and 40 percent by 2050.[23] Moreover, energy prices in the Washington, DC region have increased between 2000 and 2005 (14 percent for electricity, 53 percent for natural gas, 68 percent for gasoline) and are likely to continue to rise.[24] A recent energy strategy performed for one local authority in the Washington, DC region (Loudoun County) assessed that approximately one-half of all energy used by the county was wasted from conversion and transmission losses in electricity generation.[25] The same study indicated that total energy use per square meter of residential and commercial space in Loudoun County was about 700kWh per square meter.[26] Finally, a study by the Virginia Center for Coal and Energy Research assessed that there is less than 100kW of renewable electricity from solar photovoltaic and wind energy produced in all of Northern Virginia.[27]

National-level policy efforts taken to date appear to be insufficient to slow down and ultimately reverse the energy demand curve. These insufficiencies include, but are not confined to, the lack of integrated transportation and spatial planning policies, consistent and comprehensive energy efficiency standards for homes and buildings, or the absence of obligatory performance targets for renewable energies. On the transportation side, both the number of vehicle miles travelled is increasing, and the fuel use per mile is decreasing. The buildings picture is similar. Although there are currently 20,000 registered buildings under the U.S. Green Buildings Council's (USGBC) LEED rating system, the rate of certifying new buildings and the retrofit of existing buildings would have to increase logarithmically in order to adequately cover the approximately 129 million residential and 10 million commercial structures in the U.S. within a reasonable period of time.[28] There is also strong evidence to challenge the supposition that voluntary rating systems such as LEED are in fact creating sustained levels of energy efficiency in buildings—a challenge recognized by USGBC in its recent revisions of the rating system. In light of these statistics, framing the focus of energy and climate change mitigation planning at the level of the individual building or the individual journey does not appear to be an option in the United States. Similarly, recommending predominantly voluntary measures must be examined more closely for effectiveness.

The planning response at the state and local level also is incomplete. For example, Virginia has developed a state-wide energy and climate plan that targets greenhouse gas emission reductions of 30 percent below the business-as-usual projection of emissions by 2025. However, there are no concrete implementation plans linking short and long-term quantitative performance benchmarks, large-scale integration of land-use, transportation, energy efficient housing and buildings, cogeneration, renewable energy, and more efficient use of grids and networks. At community levels and with the best of intentions, governments such as Arlington County created and launched “Cool Counties,” an initiative designed to cut county-wide greenhouse gas emissions 80 percent by 2050. However, the scope of Cool Counties and related efforts are mostly confined to emissions from government activities or small demonstration projects at the scale of individual buildings or homes. Up to 2009, Arlington County’s climate strategy addressed less than 10 percent of all emissions from within the county.[29]

In December 2009, in an effort to respond to long-term competitiveness, energy, and greenhouse gas emissions challenges, Loudoun County and Arlington County undertook the development of the first long-term community energy planning strategies in the Commonwealth of Virginia. These strategies addressed all energy uses by all activities within each county, both private and public. The two efforts are unique in that each reflects efforts to replace aspirational rhetoric with problem-focused and goal-oriented planning anchored in quantitative benchmarks and analysis.

03

CORE ELEMENTS OF COMMUNITY ENERGY PLANNING

CORE ELEMENTS OF COMMUNITY ENERGY PLANNING

Community energy planning blends three core principles into the following typology:

- Reduce the demand for energy by avoiding waste of energy and implementing energy-saving measures;

- Use sustainable sources of energy rather than fossil fuels; and

- Produce and use fossil fuels as efficiently as possible.

Lysen has referred to these efforts as the "Trias Energetica."[30] In California, a version of this classification has been referred to as the "California Loading Order," which was informed by lessons from Germany.[31] We suggest that conscious transfer of community energy planning policies from Germany to the U.S. and the technical and policy innovations associated with the implementation draws from this typology. Successful CEPs incorporate the attributes listed in the following paragraphs. In the U.S., the roles of heat recovery and cogeneration in the urban setting are relatively underemphasized elements, representing one of the substantive differences between the U.S. and German approaches.

World-Class Energy Efficiency

In North America and Europe, homes and buildings account for more than 40 percent of all primary energy consumption.[32] To reduce demand for energy, community energy plans inevitably have a major emphasis on energy efficient standards for all buildings and housing that are regularly and upwardly adjusted. A 2007 McKinsey & Company study suggested that energy efficiency improvements in buildings (e.g., lighting and heating, ventilation, and air conditioning systems) could be undertaken for less than $50 per metric ton of avoided emissions of greenhouse gases and that the energy cost savings are substantially greater than the investments.[33] Germany, and to a lesser extent California, have been leaders in the development and implementation of framework laws that mandate construction and energy performance standards and are incrementally tightened. Germany also has been a leader in the implementation of such tools such as energy performance labels (*Energieausweis*) that broadcast the performance measures of the building or apartment. The energy performance label is available to a tenant or buyer at the time of purchase or lease, helping buildings maintain their energy performance through their operating lives.

Planning That Integrates Land-Use and Transportation

In Germany and the U.S., the movement of people and goods accounts for approximately 28.5 percent of energy consumed.[34] Moreover, Hirt has documented the historical reliance of U.S. cities on monosectoral zoning that has discouraged mixtures of social, environmental, and economic uses that integrate the urban fabric.[35] To avoid waste of energy in the transportation and other sectors, community energy plans depend on land-use planning supported by transportation plans that promote density, mixed uses, and transportation alternatives, such as walking, biking, public transit, and smaller motorized vehicles including two-wheelers. In Germany, national land-use and transportation policies have been harmonized resulting in a transportation split that is approximately 40 percent focused on modes other than individual vehicles. Zoning in German cities encourages mixed social, commercial, industrial, and environmental uses—typically around multiple transit centers. Urban transportation systems have extensive networks of bikeways, subway, and light rail stations; pedestrian zones all supported by taxis; and car-sharing networks to fill gaps between mass transit and individual vehicles. Public transit is usually characterized by real-time signage, maps displaying schedules and routes, shelters, and benches. Contrary to frequently held impressions, overall subsidies from the German federal government account for less than 30 percent of the operating costs of transportation, versus 60 percent in the U.S.[36] The transport of industrial goods has a similar multi-modal layering with integrated policies encouraging the use of energy-efficient freight rail, rivers and canals as conduits into and from urban settings, and zoning cities for ease of access by smaller trucks.

Efficient Energy Conversion and Heat Recovery

In the U.S., approximately 50 percent of electricity is produced by coal-burning power plants, which consume far more energy to make unused heat than useful electricity. These plants never operate at more than 40 percent efficiency.[37] They are not often proximate to urban regions and therefore unable to recapture waste heat. Even if they were closer, there is little infrastructure available to use it. Typically, within the U.S. model, approximately 10 percent of additional energy is lost via the power lines transmitting the electricity from generally rural generation sites to urban consumers. Community energy plans make better use of fossil fuel through efficient capture and distribution of heat. Many German cities such as Mannheim have successfully created district energy systems in which “waste” heat from large utilities or industrial sources has been captured and channeled efficiently via cogeneration (and increasingly via micro-cogeneration plants) and district heating systems. Urban planning in Germany encourages the development and expansion of district energy systems by promoting density and the inclusion of larger scale energy sources within an urban area and appropriate energy supply zoning policy. As a result, high percentages of homes and buildings in Germany are served by district heating (or cooling) systems. Nationwide, about 14 percent of the dwellings are supplied by district heating systems (with a remarkable difference of 9 percent in the western states versus 32 percent in the former East Germany. In cities with greater than 100,000 inhabitants, the district heating share is 30 percent and exceeds 50 to 60 percent in several cities.[38] This improves conversion efficiency both through cogeneration and by avoiding the underutilization and over-sizing of individual boilers and furnaces. By contrast, in the U.S., the legacy of district heating systems from the first half of the twentieth century, mostly using inefficient steam distribution, have been shrinking and many have been completely decommissioned. A very small handful, such as the one serving the St. Paul, Minnesota central business district, is being extended and upgraded to modern standards.

Multi-Fuel Flexibility and Renewable Energies

In the U.S., renewables contribute only 6 to 7 percent of commercial energy.[39] Moreover, U.S. cities and regions lack a coherent range of financial and policy incentives to accelerate deployment of renewable energies. Compounding the problem, cities and regions in the U.S. often lack elemental tracking systems to record and monitor the development and effectiveness of renewable energies. A core element of community energy planning is the large-scale and cost-effective deployment of renewable energies that consider the unique climatic and topographic attributes of the city or region. German cities such as Freiburg, Hamburg, and Berlin have aggressive renewable energy policies for solar, biomass, and wind. They also have developed multiple and distributed fuel sources that blend renewables with conventional fuels such gas, coal, and municipal wastes.[40]

Integrated Utility Approach and Energy Distribution

In North America, urban energy systems are highly dependent on one or two sources of fuel, typically with large central power plants providing most electricity and natural gas networks providing most thermal energy. Each is delivered by completely separated utilities. Many German cities are characterized by the integrated management of energy supplies, including delivery of heating and cooling via district energy networks as well as electricity, gas, water, and sewage services. These systems are able to draw from a range of traditional and renewable fuel sources including waste heat and distribute a range of energy service products throughout the city. In Mannheim, as in many other European cities, most energy-related services are sold by a single municipal utility to the majority of the city's residents, businesses, and industry. The services include electricity, natural gas, district heating, district cooling, water, and waste water. The Mannheim utility (MVV Energie AG), is a public-private partnership with the city retaining 50.1 percent equity, which ensures civic control over service quality and affordability and provides both a revenue stream for the city and attractive profits for the shareholders. The common ownership discourages duplication of infrastructure and is supported by an innovative zoning for "thermal networks," to encourage investment, modernization, and growth. Zhivov et al has urged U.S. electric utilities to consider the experience of their German counterparts who use the integrated utility approach to consider the sale of waste as a potentially profitable and environmentally effective revenue source.[41]

Scale

In the U.S., there has been a growing visibility and promotion of "green" buildings. However, the success of "green" buildings has all too often been defined by a few hundred individual stand-alone showcase buildings. For community energy planning to succeed in the U.S., consistent and large-scale development needs to take place at a neighborhood scale. These are typically somewhere between 5 to 50 hectares (12 or 150 acres) or even larger. In the absence of equivalent statutory European-style national or state-level community energy planning policies in the U.S., scale projects like these allow the integration of land-use, heat recapture, renewable energies, energy efficient building development, and transportation alternatives can be undertaken with higher performance results. Implementing multiple such projects within a single community will eventually transform the energy performance of the entire community. Freiburg's Vauban, Hamburg's Hafencity, or Stuttgart's Scharnhauser Park are model "scale" projects.

Community Engagement Informed by Quantitative Benchmarks

The development and implementation of community energy plans depend upon informed leadership and a decision-making process that draws from international and quantitative benchmarks. Transparency is necessary to communicate results and in ways in which technical information is broadcast in laymen's terms to facilitate inclusion at all levels. Performance measures for energy labels and CO_2 emissions for automobiles are among the multiple ways that community energy management in Germany is informed by quantitative benchmarks.

04

EUROPEAN AND GERMAN POLICIES SUPPORTING EFFECTIVE COMMUNITY ENERGY PLANNING

CONTEXT OF EUROPEAN AND GERMAN POLICIES SUPPORTING EFFECTIVE COMMUNITY ENERGY PLANNING

Germany and other European countries' leadership in energy management and experience with community energy planning did not emerge out of a vacuum. At both the EU and German national levels, community energy planning practices emanated from a long-term and comprehensive process affected by efforts to address energy security, economic development, and environmental protection. To better understand the relevance of community energy management plans in Germany and their relevance for the U.S., this section summarizes key energy policy frameworks of the European Union, Germany, and sub-national policies. Appendices A and B contain further details of the directives, programs, and initiatives for each level of governance affecting community energy planning in Germany.

European Union

Since its formation as the European Coal and Steel Community, the European Union has been leading coordination of energy-related policies across member states, in part to support post World War II economic growth and in part to strategically manage its energy needs at a time of Cold War confrontation with the former Soviet Union and its allies in the Warsaw Pact. The focus on energy heightened with the "perfect storm" of the late 1960s and into the 1970s. Concerns about energy security due to the embargo from oil-producing countries in the Middle East and the risks of dependence on high quality fossil fuels from the former Soviet Union and Eastern Europe increased. These concerns were added to by the negative economic effects of high energy prices from both politically-driven high pricing by multiple national state energy monopolies and the impact of the 200 percent oil price increase during the first oil embargo of 1973. On the environmental front, degradation from acid rain in politically influential countries such as Sweden and Germany completed the "perfect storm."

The earliest policy responses that became integrated community energy planning were from individual countries, starting with Denmark, closely followed by Sweden and Germany, in the form of energy efficiency building codes. The U.S. National Research Council reports that the introduction of energy efficient building codes in Denmark alone dropped space heating and warm water consumption from 75 million BTU to 54 million BTU between 1972 and 1984.[42] However, despite a second Middle East oil embargo following the Iranian Revolution in 1979, national-level concerns over energy supply weakened and trumped most efforts to develop comprehensive European-wide legislation for energy and the liberalization of national energy markets. The still early state of EU integration was clearly an added factor preventing continent-wide energy policies.

Until 1992, the European electricity and gas markets were often monopolies dominated by national or a handful of heavily regulated private authorities. This pattern was broken under Prime Minister Margaret Thatcher with the liberalization of the British electricity and gas markets into a more competitive framework. In 1986, the Single European Act created the basis for an EU-wide open market in goods, services, capital, and labor. This combined with earlier national efforts in energy efficiency and market restructuring and led to a wave of EU-level initiatives that were to frame community energy planning via the liberalization of the gas and electricity sectors and the regionalization of efficiency.

The EU passed the first directive promoting common rules for electricity in 1993 followed by natural gas in 1998. The directives opened up a long-term process of retail and wholesale energy market liberalization and lessened state control of investment of power stations and transmission lines.[43]

A concurrent concern about the environment, specifically the proliferation of nuclear energy plants, acid rain, and increasingly climate change in the early 1990s also contributed to the development of EU policies supporting energy efficiency. Energy efficiency legislation in the EU had a tendency to develop rather separately and sometimes in different ways in individual EU member states. The EU set ambitious targets for greenhouse gas reductions for the first 1992 UN Conference on Climate Change (UNFCC) in Brazil—specifically the stabilization of carbon dioxide emissions at 1990 levels by 2000.[44] A multi-sectoral policy framework (the Fifth Environmental Action Programme) emerged that fused energy, urban development, and environmental initiatives. Specifically noteworthy was the development of the first generation of EU-wide directives affecting energy efficiency in buildings via the "Specific Actions for Vigorous Energy Efficiency" Directive (SAVE),[45] which enhanced the harmonization process between the individual legislations.

Policy frameworks for community energy planning in Europe moved forward in 1997, when the EU proposed to tighten its greenhouse gas emissions reductions targets of greenhouse gases to 8 percent compared to 1990 levels under the Kyoto Protocol. A "burden-sharing" ratio of emissions reductions was developed among member states that considered special domestic circumstances for economic growth trends, energy mixes, and the composition of the industrial sectors.[46] Germany's emissions reductions target was 21 percent below 1990 levels, whereas Portugal was allowed a 27 percent increase.[47]

In 2000, the "European Climate Change Programme" (ECCP) was developed and framed policies and efficiency measures for the transport, renewable energy consumption, energy, and industrial sectors. Parallel to EU policies promoting energy efficiency, the EU also started to focus on renewable energy, as seen in the approval of the "Directive on the Promotion of Electricity Produced from Renewable Energy Sources in the Internal Electricity Market," in 2001. The objective of the Directive was to increase renewable energy's share throughout the EU to 12 percent of primary energy consumption and boost renewable sources to 22 percent of electric power generation by 2010 (excluding heavy hydro).

In 2002, EU-level policies continued focusing on energy efficiency with the approval of the passage of the EU Directive on Energy Performance of Buildings (EPBD). The EPBD was unique in that it created a harmonized calculation methodology and minimum standards for energy performance of new buildings and existing buildings undergoing renovation across the European Union. It also is globally recognized as the first law to require sellers and leasers of new or existing home and buildings to provide "Energy Performance Labels," building on national trials in some German states and Denmark. A focus on the transportation sector followed in 2003, with the adoption of the "Directive on the Promotion of Renewable Fuels for Transport," which promoted biofuels as a replacement for diesel fuels.

In 2003, climate change concerns merged with more EU-wide efforts to promote energy efficiency by restricting greenhouse gas emissions from industrial sources and energy installations using the Cap-and-Trade Mechanism available under the Kyoto Protocol. This resulted in the landmark European Union Emissions Trading System (EU ETS). The EU ETS aimed to cut emissions from the 12,000 industrial and energy installations in Europe with a net heat usage of 20 megawatts (MW) or higher by instituting a system of greenhouse gas emissions caps for each member state. Collectively, these installations make up over 40 percent of greenhouse gas emissions in the EU. With the EU ETS, member states must monitor and report to Brussels greenhouse gas emissions under an EU-wide allocation plan. Excessive emissions by member states under the plan could be mitigated by trading allowances within prescribed trading periods. The first trading period started in early 2005 and after many initial challenges the EU ETS has become established and is positioning the rules for the post-2012 period. Today, the market in emissions credits exceeds $120 billion and is expected to grow substantially.[48]

Recognizing the importance of cogeneration in meeting aggressive greenhouse gas and efficiency targets, in 2004 the EU passed the "Directive on the Promotion of Cogeneration Based on Useful Heat Demand in the Internal Energy Market." This Directive established clear definitions, market frameworks for combined heat and power (CHP), and planning and reporting requirements by member states. In 2006, a collective and integrated approach to energy management emerged with the "Energy Plan for Europe" (EPE), which included the approval of the "Directive on End-use Efficiency and Energy Services" in 2006. This Directive requires member states to develop national energy efficiency strategies and aspired to cut final energy consumption 9 percent by 2015. It also establishes some market rules to allow energy efficiency to compete on a level playing field with energy supply.

In 2007, Germany, under the chancellorship of Angela Merkel, initiated the "Triple 20." This was an EU-wide initiative integrating climate and energy policy measures to reduce greenhouse gas emissions by 20 percent from 1990 levels, increase the share of renewable energies in total energy consumption by 20 percent, and increase energy efficiency by 20 percent. The promotion of energy efficiency in the built environment was supported by the passage of the Directive on Cogeneration and the 2008 strengthening of the EPBD. The revisions to the EPBD included removal of the 1,000m^2 threshold for national minimum energy performance requirements.

This lengthy and often fractious and controversial evolution has resulted in an EU-wide set of laws and guidelines that cover most aspects of energy productivity from end-use to fuel choices, all collectively aimed at meeting aggressive greenhouse gas reduction targets, ensuring supply security, and maintaining reasonable affordability.

Performance Indicators between the EU and the U.S.[49]

	EU	**U.S.**
Population (2009)	492M	310M
GDP (2009)	$16.2 Trn	$14.2 Trn
Percentage of World Primary Energy Consumption (2006)	15%	21%
Primary Energy Consumption in Million Tons Oil Equivalent (2006)	1,806	2,502
Energy-Related CO_2 Emissions (Metric Tons Per Capita) (2006)	8	19
Energy Intensity (Primary Energy in kWhe/Dollar of GDP) (2006)	1.3	2.1
Energy Per Capita (Primary Energy in MWh/e/Capita) (2006)	42.7	93.9

German National-Level Policies

Germany's early industrialization had depleted quality domestic coal stocks. This and the division of the country coupled with the lack of domestic gas and oil made Germany particularly vulnerable to the 1970s oil crisis. Germany's lack of access to energy supplies from the Soviet Union in the 1970s and 1980s added to its vulnerability during the oil embargos from the Middle East. These factors, combined with strong national environmental sentiments about nuclear energy and its deep-rooted historical cultural identity with the protection of its environment (particularly its forests), pushed Germany ahead as a leader in energy efficiency in general and community energy planning in particular.[50]

Like other European countries, especially in Scandinavia, the emergence of community energy planning practices in Germany was grounded in the combined approach to energy supply security and environmental protection. The environmental effects of acid rain were addressed via a battery of command-and-control policies to contain sulfurous and nitrogen-based emissions.[51] Supply security was addressed through an incremental and persistent collection of energy efficiency and renewable energy policies. In 1974, Germany was one of the first European countries to approve minimum energy standards for buildings, including air tightness, double-glazing, and thermal insulation via the Thermal Insulation Ordinance (*Wärmeschutzverordnung*, WschVO).[52] Germany also launched one of the first large-scale renewable energy research programs via the GROWIAN wind turbine research initiative, national-level policies integrating land-use and transportation, and sustainable water infrastructure.[53]

The formation of German community energy planning policies gained strength in the 1990s after the reunification of East and West Germany. The energy and economic dependence on lignite mining (*Braunkohle*) in the former East Germany provoked serious debate about decoupling environmental degradation and economic development. In 1991, Germany moved support for renewable energy beyond research and toward more formal applications by passing the national "Federal Electricity Feed-In Law" (*Stromeinspeisegesetz*, StrEG). The StrEG was one of the first national-level policies in the world that obligated public utilities to link renewable energy generators (wind, solar, biomass, and landfill gases) with financial and fixed-rate remuneration (between approximately 65 to 90 percent of average retail rates). The influence on renewable energy, especially wind, was pronounced. Between 1989 and 1995 installed capacity of wind energy increased from 20MW to 1,100MW.[54]

Other landmark energy policies approved at the time included the National Tax on Oil (*Mineralölsteuer*) in 1992, a tax on all oil-based fuels such as gasoline, heating oil, and natural gas to service national transportation infrastructure.[55] In 1992, Germany also ratified the United Nations Framework Convention on Climate Change and committed itself to a 21 percent reduction of greenhouse gas emissions between 2008 and 2012 under the EU burden-sharing process of the Kyoto Protocol.[56] Additional national-level policies were added in 1998, when the coalition between the Social Democratic and Green parties passed a moratorium on the construction of nuclear energy. This parallel agreement called for a complete closure of all nuclear power plants in the country by 2025. The Ecological Tax Reform (ETR; *Ökosteuer*), the Renewable Energy Sources Act (*Erneuerbare Energien-Gesetz*, EEG), and Energy Reform Act (*Gesetz zur Neuregelung des Energiewirtschafts-rechts*, EnWG) followed.

The ETR, approved in 2000, taxed gas and oil consumption and directed the proceeds (over €18 billion) to offset payroll taxes for retirement pensions from 42.3 to 34.6 percent of gross wages.[57] The tax rates included gas and diesel fuel (0.06 DM per liter), heating oil (0.04DM per liter), natural gas (0.0032DM per kilowatt hour), and electricity (0.02DM per kWh). Renewable energy sources, small power plants (less than 0.7MWh production), electricity from cogeneration (as long as its overall fuel efficiency exceeded 70 percent), nuclear, and coal were spared from the tax.[58] This is one of the first worldwide examples of cogeneration receiving the same treatment as renewable energy. Exceptions were made for specific sectors whose consumption exceeded certain thresholds to pay less in order to encourage economic competitiveness (mainly manufacturing, mining, or construction).

In 2000, the German government passed the EEG to compensate for the weaknesses of the StrEG, particularly the inadequate economic incentives for solar, and to help Germany reach its targets under the 1997 Kyoto Protocol. The goal of the EEG was to double national renewable energy production—particularly wind and solar—from 6 percent to 12.5 percent by 2010.[59] The law obligated grid operators to pay a feed-in tariff to all producers of renewable energies. Remuneration was adopted starting from the original law via two amendments from 2004 and 2008, to reflect economic developments and increased competitiveness of individual renewable sources, but the core principles of the EEG were long-term (twenty years) fixed and regressive feed-in tariffs per kilowatt hour for the selected renewable energy sources . The intent of the EEG was to bridge economic stability and technological innovation in the renewable energy sector by merging long-term guaranteed tariffs with renewable energy producers and fixed-percentage digression rates. To further stimulate the application of solar photovoltaic energy, especially in the housing sector, in 1999 the German government launched the 100,000 Solar Roofs Program (*Hunderttausend-Dächer-Programm*, HTDP) and the Market Incentive Program (MIP). Each of these programs made available loans below market rates for the installation of solar PV greater than 3kW and over €887 million to support commercialization and deployment of renewable energies.

In 2002, to address energy efficiency in buildings, the German government implemented the EU building energy performance label directives by amending the 1976 Energy Conservation Act (*Energieeinsparungsgesetz*, EnEG) with the new Energy Savings Ordinance of 2002 (*Energieeinsparverordnung*, EnEV). The changes were significant, given that approximately 40 percent of final energy consumed in Germany was, and continues to be, used for heating and hot water in residential and commercial buildings.[60] Together, the EnEG and the EnEV aimed to lower primary energy consumption by 30 percent in the building sectors compared to the preceding ordinance, the 1995 Wärmeschutzverordung (WschVO 95). Besides defining a standardized methodology to calculate primary energy demand per square meter (depending on the surface-volume ratio), the new EnEV essentially unified two earlier ordinances—the WschVO 95, which prescribed certain insulation levels for building elements (walls, roofs, windows) and the *Heizungsanlagenverordnung* (HeizAnlVO), which prescribed specific efficiency levels for the heating installations. These specific requirements were enhanced by primary energy efficiency targets, giving building owners more freedom in their choice of building construction and heating equipment, and concurrently reducing the primary energy targets to levels of about 30 percent less than the WSchVO 95. Since its first version EnEV 2002, the Ordinance has been updated repeatedly in 2004, 2007, and 2009. The most recent version, EnEV 2009, increased the primary energy efficiency target by another nearly 30 percent. The scheduled updates propose another 30 percent increase starting in 2012. At the same time, and in line with the overall requirements of the EU Directive, the laws also mandated the development and display of energy performance measures via building certificates for new residential and commercial buildings, and minimum standards for building retrofits.

In 2002, in response to the 1996 European Electricity Directive requiring member states to open their electricity markets and to meet its need for efficient heating, Germany passed the Cogeneration Law (*Kraft-Wärme-Kopplung Vorschaltgesetz*, KWKG). Like the EEG, the KWKG also provided incentives such as guaranteed feed-in tariffs for the use of cogeneration and micro-cogeneration from conventional fuels such as natural gas, and from biofuels. The KWKG also promotes the development and application of small industrial units and retrofits of plants larger than 2MWe. Again, this is an example of an emerging consistent national policy to maximize the use of cogeneration to improve primary fuel efficiencies. German policies for community energy planning were strengthened with the approval of the August 2007 Meseberg Summit. The coalition government of Christian Democrats and Social Democrats approved a twenty-nine point national “Integrated Energy and Climate Program” of the German Government (*Integriertes Energie- und Klimaprogramm*, IEKP).

The key objectives emanating from the Meseberg Summit of relevance to community energy planning include:

■ Amendments to the KWKG and an increase of the share of combined heat and power generation by 2020 from current levels of 12 percent to 25 percent. This can only effectively be achieved if significant new heat consumers are connected to cogenerated heat supply, the most obvious way being the expansion of urban district energy systems.

■ Amendments to the EEG to increase the share of renewable energy in the electricity sector from 13 percent to between 25 percent and 30 percent by 2020, and to upgrade the national power grid for higher feed-in capacities for renewable electricity. The EEG amendments from 2009 raised the tariff for wind to €.092 to .15/kWh) and for solar photovoltaic (€.33 to .43/kWh). Generally speaking, the closer to the final use, the more effective renewable electricity is.

■ Amendments to the EnEV by tightening energy efficiency in buildings by 30 percent from 2009 and by another 30 percent by 2012; making available €700 million annually for residential building retrofits in 2008 and 2009 and €200 million for retrofits of public buildings (such as schools, nurseries, etc.).

■ Amendments to the Renewable Energies Heat Act (*Erneuerbare-Energie-Wärme-Gesetz*, EEWärmeG) and a 14 percent increase of heat consumption from renewable sources by 2020 (from 7 percent in 2007). There also are plans to make available €350 million each year for building retrofits and renewable energy systems such as solar thermal collectors, wood pellet stoves, and boilers and heat pumps. With solar thermal regulations, the size of the solar panel required will depend on the size of the house: solar panels will need to have an area equal to 4 percent of the total area of a house. Fines of up to €500,000 can be levied on anyone failing to switch heating systems. The government has also launched a loan program to improve insulation in the country's housing stock by issuing no-interest loans for new construction up to €75,000, where certain efficiency levels are met. The loans are issued via the *Kreditanstalt für Wiederaufbau* (KfW), a federal and state-owned financing institution originally setup from the European Recovery Program.

The approval of legislation since 2007 has been relatively swift. Under the new EnEV amendments, all new homes built in Germany after January 2009 must have renewable energy heating systems, such as geothermal, wood furnaces, or solar, to meet at least 14 percent of the heating or water requirements. Retrofitted buildings will have to take at least 10 percent of their heating and hot water requirements from renewable energy. Combined with increasingly efficient district energy systems, this will rapidly increase the primary fuel efficiency of urban environments.

Since 1990, the consumption of primary energy in Germany has remained stable, despite a nearly 30 percent increase in real GDP. Germany's efficiency gains between 1990 and 2007 were approximately 25 percent and energy consumption per capita was the same in 2006 as in 1990.[61] Since 1990, Germany has increased the renewable share of electricity production from less than 3 percent to over 14 percent.[62] Over the same period (1990-2010), net electricity consumption in Germany grew by approximately 5 percent, while carbon dioxide emissions from the electric power generation sector declined by 18 percent in absolute terms.[63]

Comparative Indicators between Germany and U.S.[64]

	Germany	**U.S.**
Population (2009)	82M	310M
GDP (2009)	$3.7 Trn	$14.2 Trn
Percentage of World Primary Energy Consumption (2006)	2.8%	21%
Primary Energy Consumption in Million Tons Oil Equivalent (2006)	330 toe	2,502 toe
Energy-Related CO_2 Emissions (Metric Tons Per Capita) (2006)	10	19
Energy Intensity (Primary Energy in kWhe/Dollar of GDP) (2006)	1.0	2.1
Energy Per Capita (Primary Energy in MWhe/Capita) (2006)	46.8	93.9
Light Vehicle Fuel Consumption (Miles/U.S. Gallon) (2006)	20	30
Light Vehicle Fuel Consumption (kWhe/Passenger Mile) (2006)	.91	1.87
Journeys by Light Vehicle (% of Total) (2006)	61%	86%

05

COMMUNITY ENERGY PLAN CASE STUDIES IN BADEN-WÜRTTEMBERG

INTERNATIONAL BENCHMARKING: COMMUNITY ENERGY PLANNING CASE STUDIES IN BADEN-WÜRTTEMBERG

Since the 1970s, the state of Baden-Württemberg has been considered an energy and environmental pioneer in Germany. The state's economy is diverse, with service, agricultural, and light and heavy industrial sectors that have promoted a blend of energy policies. Emissions of CO_2 in Baden Württemberg currently account for approximately 10 percent of Germany's total greenhouse gas emissions and are currently at 75 million tons per year. Between 1993 and 2003, emissions of CO_2 in Baden Württemberg remained stable at approximately 7.3 million tons per person, despite a population increase from 8.5 to 10.6 million people.[65] Since 2005, the policy of Baden-Württemberg has been to reduce greenhouse gas emissions 20 percent by 2020, in line with EU and German climate policies. Currently, Baden-Württemberg's electricity sources come from nuclear (50 percent) and coal (28 percent). The approximately 12 percent balance is from renewable sources—up from 6.5 percent in 1998.[66]

The cornerstone of Baden-Württemberg's current energy and climate planning is the Climate Protection 2010 (*Klimaschutz* 2010). Launched in 2005, the goal of Climate Protection 2010 is to reduce statewide emissions of greenhouse gases from 75 million to 65 million tons by 2010; increase energy productivity by 2 percent per year by 2020; and reduce primary energy consumption 10 percent by 2020 through energy efficiency measures, building retrofits, renewable energy, and cogeneration. Climate Protection 2010 also aspires to double electrical power associated with cogeneration to 20 percent by 2020 and increase the production of renewable energy of electricity from 12 percent in 2008 to 20 percent by 2020 as well as an increase in heat supply to 16 percent. This will be complemented by participation in the EU Emissions Trading, mostly in the energy sector, in which over 230 plants in Baden-Württemberg, or about 36 percent of emissions in 2005, are affected.[67]

The community energy planning initiatives within Climate Protection 2010 include:

- Heating with Renewable Energies. In 2008, Baden-Württemberg passed the Renewable Heat Act and Renewable District Heating and Cooling (*Erneuerbare Wärme-Gesetz*). The Act requires owners of new residential (not commercial or governmental) buildings greater than 50 square meters to cover 20 percent of heating and hot water needs through renewable energies (primarily solar thermal and biomass). The coverage must be at least 10 percent by 2010 for existing buildings if the heating system or boiler (under German law) is deemed to require replacement. The renewable energy sources recognized under the law are solar, geothermal, biomass (wood pellets or bio-oil), and heat pumps. In the event that the new residential buildings lack legitimate access or means to renewable energies, the law allows connections to district heating sources from cogeneration plants, or applications of insulation that perform 30 percent higher than those required by the 2007 EnEV. Funds from the state for support of cogeneration and district heating and cooling are permitted only when the network has reached 60 percent of its life capacity. The program is complemented by the Baden-Württemberg Renewable Biomass Program (*Energieholz Baden-Württemberg*), which since 1995 has supported the installation of wood-fired boiler plants with a total thermal capacity of over 120MW with loans, and the Renewable Energies to Support Heating and District Heating Program (*Heizen und Wärmenetze mit Regenerativen Energien*), which supports heating networks supplied from renewable sources such as geothermal, solarthermal, biomass boilers, and ground effect heat pumps, by a grant of €50 per ton of avoided annual CO_2 emissions.

■ Energy Efficiency Through Building Retrofits. Baden-Württemberg has instituted the *Klimaschutz Plus*, a state-wide performance-based grant program for retrofitting non-residential residential buildings, auditing and consulting grants, and the development of model pilot projects. The grants range between €50 per ton of CO_2 for retrofits to €75 per ton of CO_2 reduced for model pilot projects. Grants are awarded to individuals or companies based on the calculated performance of CO_2 reductions.

■ Regional Land Use and Transportation Planning in Baden-Württemberg. Baden-Württemberg is considered a model in Germany for regional land-use planning. Under the Baden-Württemberg state-wide Infrastructure Development Plan (*Landesentwicklungsplan*), thirteen regions within the state must assess and coordinate open-space and land-use planning activities. Regional Planning Associations (*Regionalverbände*) such as Stuttgart's (Verband Region Stuttgart) have responsibility for development of the regional plans and for coordinating their integration into the Baden-Württemberg State Land-Use Development Plan. The regional plan is a fifteen year vision for the region and operates under the legal authority of Baden-Württemberg's State Nature Protection Law of 1975. In Stuttgart, the Verband Region Stuttgart also is empowered to oversee that the local authorities work to integrate their local land-use and building plans (*Flächennutzungspläne und Bebauungspläne*) into the overall legally binding regional land-use plans.[68] In that context, the Verband has the authority to reject local land-use and landscape plans developed by individual cities that it interprets to conflict with regional interests. The outcomes of this planning process are unique. Einig reports that Baden-Württemberg has reduced land consumption from 3.9 to 2.5 percent since 1996.[69]

Case Study: Scharnhauser Park

In 1994, the State of Baden-Württemberg sold to the City of Ostfildern (a town of 35,000 people located on the eastern edge of Stuttgart) 150 hectares (375 acres) of the U.S. 7th Army's Nelling Barracks. After the fall of the Berlin Wall, the U.S. Army had declared the property redundant and sold the property to the state of Baden-Württemberg. To accommodate Ostfildern's population growth (around 2 percent per year), restrict sprawl development, and promote model energy efficiency programs and mixed-use diverse housing, the city coordinated a design competition for a master plan. The master plan proposed 3,500 dwellings of mixed market-priced and affordable apartments, along with 67 hectares of park and open space, 25 hectares for streets, and a light rail system around three distinct "districts." In addition to the 3,500 units for the 10,000 residents, the plan also called for commercial space of approximately 480,700 square meters to host 1,200 jobs. With the exception of the officer's quarters, the vast majority of the 157 existing barracks buildings were considered too obsolete for retrofitting and torn down.[70]

The core community energy planning dimensions of Scharnhauser Park include:

■ Heat Recovery. The plan included the deployment of a cogeneration unit for burning biomass to produce 1MW of electricity and 6MW of heat through a newly reconstructed district heating and cooling system that extends over 13 kilometers.[71] The existing district heating and cooling system was to be extended to all buildings of the project. Thermal cooling was provided via a lithium-bromide refrigerating machine, with a cooling capacity of 150kW.

■ Energy Efficient Buildings. Energy efficiency targets for the planning process included low energy standards of 60kWh/m^2a per year (or 25 percent below the 1995 German energy efficiency ordinance) for all buildings.[72] A Youth Center was built that met the German passive housing standard for heat consumption, 32kWh/m^2a.

■ Land Use and Transportation. To reduce vehicle miles travelled, parking spaces were restricted to one per commercial unit. Eighty percent of all residents at the project would be no farther than 500 meters from any light rail station.

■ Renewable Energy. A solar thermal power plant of approximately 200 square meters and a 70kW solar photovoltaic array were installed. It is estimated that the photovoltaic potential at Scharnhauser Park could cover up to 40 percent of the electricity requirements for the entire project due to the high number of flat roofs and solar reflection.[73]

■ Performance Measurements of Scharnhauser Park. Scharnhauser Park has seen 30-38 percent efficiencies when compared to the national energy savings standards. In addition, the 6MW biomass plant (with two natural gas boilers of 5MW and 10MW thermal capacity), provide 80 percent of the project's heating and 50 percent of the electrical power. In 2004, 20,000 MWh/year were produced from biomass. By 2006, this increased to 24,000MWh/year of which 81 percent emanated from biomass. Five thousand residents were housed and 1,400 jobs were created via the €150 million invested in public infrastructure (schools, etc.) and €700 million private investment.[74] By far the most important measurement is the fact that Scharnhauser Park is successful economically, with premium real estate prices, and is seen locally as an attractive place to live, work, and play.

Case Study: Mannheim

Mannheim, a city of 308,000, is located in the Rhine-Neckar metropolitan region. Its recent policy for sustainable regional development includes bridging economic growth along with environmental protection. This necessitates that CO_2 emission levels be reduced in accordance with the Kyoto Protocol. In the immediate postwar period, existing infrastructure, including a pre-existing district heating system and tramway system, were rebuilt and put back into service. Homes and buildings are efficiently constructed and managed using building performance codes that are regularly updated. A strategic decision was made in the 1980s to upgrade and extend the district heating system, and it now extends across wide areas of the city. The system serves the majority of both residential and commercial users with heating and domestic hot water. The city and its utility MVV Energie AG announced in 2008 that an additional 20,000 residential and commercial consumers will be added to the system in the next few years. District cooling is being added to serve the downtown business district and selected specific sites, including the new SAP Arena, a large sports venue.

A unique feature of Mannheim's energy structure is the creation of an industrial enterprise zone on an island in the Rhine River and its surrounding areas. This zone has a tailored energy system that supplies industrial grade steam as a community utility, in addition to supplying district heating, natural gas, and electricity. As a result, investors with specific process steam needs have been attracted to this zone in efforts to avoid significant capital and operating costs. In Mannheim, the thermal and electric networks facilitate the inclusion of multiple fuel and technology options. The bulk of the heat is sourced from a large-scale coal-fired cogeneration plant located very close to the city. The system is supplemented by natural gas, combustible municipal waste, recycled lumber from building demolition, and some solar sources.

A good example of how a flexible multi-utility system such as Mannheim can incorporate new technologies is the way Mannheim is piloting a trial of 200 appliance-sized micro-cogeneration units that fit into individual homes and act as both electricity generators and heat sources. If successful, this could put thousands of electricity and heat generators into the overall community system, owned and operated by the city utility. Grants for micro-cogeneration units of up to 11kW (electrical) are provided from the Climate Protection Funds established by Mannheim's utility MVV.

Being a predominantly seventeenth century city, the core of Mannheim is essentially designed along "new urbanism" principles, and is naturally oriented more to walking, biking, and mass transit. The tramway system has been radically updated in the past fifteen years, and is served by frequent air-conditioned light rail infrastructure. This light rail also serves as a convenient alternative to high-speed heavy rail or cars. In parallel with upgrading mass transit, the city has discouraged car use in the downtown through conveniently located central parking near mass transit, along with designating large areas of the city that are off limits to cars.

The city utility, MVV Energie AG, is itself an example of community integration unfamiliar to the U.S. Energy services—electricity, gas, district heating, and district cooling—along with water and sewer, are run by a single municipal entity. Taking advantage of market liberalization laws, in the late 1980s, this entity has emerged from being a municipal department for energy and water supply to becoming a separate legal entity fully-owned by the City of Mannheim. In 1999, it was one of the first German regional and municipal utilities to be partially privatized and converted into a private corporation—MVV Energie AG. A majority of the stock (50.1 percent) is still owned by the city, while other utilities and free-float investors hold minority participations via the stock exchange.[75]

06

TRANSFERABLE ELEMENTS OF GERMAN COMMUNITY ENERGY PLANNING TO NORTHERN VIRGINIA

PROSPECTIVE ANALYSIS AND THE TRANSFERABLE ELEMENTS OF GERMAN COMMUNITY ENERGY PLANNING POLICIES TO THE U.S.: LOOKING AT THE SPECIFIC CASE OF NORTHERN VIRGINIA COMMUNITIES

Given the political, cultural, and institutional differences between Germany and the U.S., and the very different energy journey over the last twenty to thirty years, it is unrealistic to copy the multiple layers of European Union and German national and subnational policies shaping community energy planning policies to the U.S. The complexity and differences between political systems in each country make a transfer process more likely to be characterized by piecemeal and incremental adoption of ideas followed by laws, regulation, and implementation. In addition, the U.S. importers of German community energy planning policies reviewed in this report are jurisdictions in the Commonwealth of Virginia.

Virginia is a state with a long history of strictly interpreting “Dillon’s Rule”—a doctrine held among over thirty-one U.S. states that interprets that “political subdivisions hold only those powers expressly conferred by charter or law and no other powers.”[76] In other words, local governments such as Arlington or Loudoun counties assert that the state’s strict interpretation of “Dillon’s Rule” precludes local authorities’ abilities to unilaterally administer policies supporting energy efficient building codes, renewable energy systems, or regulations specifying zoning densities without the approval of the state government.

Concerned about perceived misinterpretations by local authorities who strictly interpret Dillon’s Rule and their perceived lack of authority to administer urban growth controls in Virginia, Richardson and Gough caution towns and cities of Virginia that “in the end, neither local leaders nor state legislators should be deluded. Dillon’s Rule in no way lets them off the hook. The creation of thoughtful, effective strategies for managing growth depends largely on local and state will to do that—not on the presence or absence of Dillon’s Rule.[77]

Jacoby warns that even under very different circumstances and contexts, the barriers to policy transfer are not totally impermeable. He suggests that determined policymakers will find ways to share ideas, data, reports, and experiences, from both the U.S. and elsewhere, to inform and assess benefits and challenges to both adaptation and possible adoption.[78] Given the diverse energy frameworks and political circumstances, the study of transfer from Baden-Württemberg to Virginia is especially appealing. It is precisely this context that makes the transfer of community energy plans practical and in which the following recommendations and prospective analysis are undertaken.

Energy Efficiency

Given the economic and environmental benefits of energy efficiency improvements in buildings, Loudoun and Arlington counties could immediately learn from Germany’s experiences with commercial and residential building labels (EPLs). EPLs can build transparency on energy consumption and costs, along with greenhouse gas impacts for home buyers and renters, managers, owners, and tenants of commercial and institutional facilities. This transparency promotes market forces that will inform decisions about purchase and leases of buildings, in turn driving owners and builders to be more sensitized to the market impacts of energy efficiency. Each county would be free to voluntarily apply EPLs, starting with property it directly owns. Then through willing community players, EPLs could be extended and applied to become accepted practice without legislation vis-à-vis a mutually reinforcing snowballing effect. Within each county, neighborhood-sized

"Scale Projects" are being identified where there is willingness on the part of the owners, developers, residents, and others to embrace different energy solutions within that neighborhood. This approach where all players agree to an integrated energy approach avoids the immediate local and state regulatory challenges, but created sufficiently large areas to start the long-term process of communal transformation. Scharnhauser Park is one such example in the German context. In such a scale project in the U.S., energy performance levels for new residential and commercial construction are likely to be recommended that are 30 percent more efficient than the current Virginia State Energy Code starting in 2011. Energy performance measures for major renovations of at least 25 percent greater efficiency than the current average, starting in 2011, with incremental increases of 1 percent per year in efficiency targets, are encouraged in Loudoun County. These recommendations are similar to those proposed in current U.S. federal guidelines and also reflect similar voluntary energy efficiency construction programs such as "Energy Star" Homes and Buildings (which indicates a 15 percent improvement of energy efficiency over existing regulations). They also are consistent with what the Virginia Department of Housing and Community Development has started in the context of a re-examination of current state-wide energy codes. The difference is that they are being proposed in scale communities committed to a holistic approach to energy performance. A recent assessment of a "scale project" for 2,500 homes and 200,000 square meters of commercial property in Toledo, Ohio, suggests that the vertical construction costs at these levels of efficiency are between 2 percent to 5 percent higher than conventional construction.[79] This is far lower than often publicly perceived.

Heat Recovery and Utility

To achieve county-wide reductions in energy and carbon intensity of 50 percent or more over the long term, Loudoun, Arlington, and other jurisdictions in the region would almost certainly consider including "District Energy Zones" similar to Mannheim and most other major cities in Baden-Württemberg and elsewhere in Germany and Europe. District energy networks could be constructed to supply heating, domestic hot water, and cooling to higher density new developments or major redevelopments. Given the existing and proposed densities, a variety of local and neighborhood district energy approaches could facilitate the implementation of combined heat and power that in total has at least a 100 MW (electric) capacity by 2040 is feasible for either jurisdiction. This alone would make a significant impact on reducing summer peaks, in turn reducing the pressures on the regional grid. District energy networks will enable the efficient and economic distribution of the heat generated by combined heat and power and from other sources.

Efficient construction, combined with district energy supplied by distributed CHP and other heating sources where appropriate, is a proven way to dramatically reduce total energy requirements; avoid high levels of electricity conversion losses; and provide lower cost, reliable heating and cooling services. In Loudoun and Arlington counties, transit-oriented mixed-use developments, recreation centers, military facilities, academic campuses, and some neighborhood renewal projects have all been identified as potential "scale projects" where integrated energy solutions can be started. In addition, with today's technology options, it is feasible to consider distributed CHP even on single developments larger than approximately 10,000 square meters, such as a shopping or commercial complex.

Interestingly, there is a growing pool of investors and qualified operators willing to invest in and operate clean and renewable energy supply and distribution systems. All too often, they have difficulty finding projects that are both large enough and have enough community support. At a minimum, the jurisdictions of the region could request an evaluation be completed as part of the planning request to gain transparency of the potential benefits and challenges for all parties. The benefits often include reduced vertical construction costs by eliminating individual chillers, furnaces, and boilers while building to efficiencies above existing code levels. The net effect may be minimal or no construction cost impact. There is a growing body of evidence that an efficient commercial building increases productivity and reduces operating costs, making it more rentable and higher in value.[80]

By transferring structures and concepts of district and local energy supply systems from Baden-Württemberg, the energy services use low-risk, proven technology offering predictable investment, operating costs, and long-term stable rates of return between 10 and 20 percent at the present levels of energy pricing in the region—which is one of the lowest in the U.S. Highly likely increases in prevailing prices can only increase returns. The local government and community get potential contribution to public funds from any energy services companies if they are structured as public-private partnerships.

There also exists the possibility to team with Baden-Württemberg to study the viability of micro-CHP large-scale deployment in lower density neighborhoods and to supply smaller single developments. This is particularly important in parts of Arlington and Loudoun counties where, as in much of the U.S., there is a larger proportion of lower density development than is typical in Baden-Württemberg. Currently, micro-CHP technology is not economically viable but this may change as technology costs go down and energy prices go up.

From a regulatory standpoint, interestingly there are minimal barriers to implementing district energy in Virginia, other than the provision of public rights of way for infrastructure, which can mostly be resolved at the county level. In contrast, implementing CHP has a number of overlapping challenges from the standpoints of the developer, existing utilities, current public service regulation, land-use planning, and end-user. From a regulatory standpoint, the interconnection of CHP with the existing electrical grid walls under the Commonwealth of Virginia State Corporation Commission rules governing connection costs and technical requirements. Traditionally, these rules, like most U.S. states, have not actively encouraged distributed generation. The overall trend in the U.S. is for interconnection conditions to become more CHP friendly—a trend that is likely to accelerate. Overall, CHP projects should be considered where their unsubsidized rate of return is better than 10 percent with reasonably conservative assumptions. This is increasingly typical. Investors are looking for suitable CHP projects in which to invest. Most natural gas CHP engines or turbines can be easily adapted to use of biogas and can thus support a renewable fuels strategy.

Interestingly, the need for the U.S. Army to consider European-style district energy systems on their larger bases was called out in a 2006 U.S. Army Corps of Engineers report that assessed the applications of district energy systems of U.S. Army bases in Germany.[81] This was conducted by experts from Baden-Württemberg on the Fort Meyer Base in Arlington County, to some extent based on the experiences of the U.S. Army at their facilities in Mannheim.[82] It is an interesting irony of history that the transfer of energy best practices from Baden-Württemberg to the U.S. started some years ago in Arlington, Virginia, at least as far as the U.S. Department of Defense is concerned.

Integrated Land-Use and Transportation

To promote energy efficiencies in the transportation sector, Loudoun and Arlington already have many transit-oriented and mixed-use development planning guidelines. This is arguably more so the case in Arlington. The recent baseline energy assessment of Arlington County showed its transportation energy use and greenhouse gas emissions were proportionally lower than the U.S. and its neighbors in Northern Virginia. These guidelines can be intensified and put to greater use through clean fuels programs that encourage availability of lower impact fuels including clean diesel, biofuels, and recharging stations. Ewing et al., documented the energy efficiencies of development around public transit centers and development that combines mixed-uses, shorter commutes, walking, and cycling.[83] The counties may also encourage smaller vehicles through urban design and parking strategies as well as clean diesel, diesel/gas hybrid vehicles, or all-electric vehicles through pilot projects for recharging stations. Hirt has observed that U.S. zoning laws promote mixed uses similar to those in Stuttgart, which can be applied in the mono-sectoral zoned U.S. suburban areas. Hirt adds that U.S. towns and cities aspiring to adopt the German urban zoning model, such as Stuttgart's, start incrementally by, for example, approving zoning first for bed and breakfasts in residential neighborhoods rather than hotels.[84]

Mixed Fuels and Renewable Energies

The 2007 Virginia Energy Plan assessed that there is approximately 50 MW of biomass and waste-to-energy online with no significant heat recovery.[85] The same plan estimated less than 100 kW of solar photovoltaic capacity installed and no wind generation. The relatively low level of class 3 and higher wind areas in both counties preclude wind as a viable renewable energy alternative. However, both Loudoun and Arlington counties have the potential to supply as much as 25 MW solar photovoltaic (PV) by 2016 and up to 100 MW by 2040. Combined with district cooling and CHP, this could reduce well over 25 percent of summer peak electricity demand on the grid.

Both counties could deploy collectively approximately 15 million square meters of solar photovoltaic across the county by 2016, rising to about 90 million square meters by 2040. This could be accomplished by working with the state utility to develop a regional deployment plan calling for investment, ownership, and operating aspects and includes a mix of Individual residential and commercial rooftop installations, solar PV "farms" potentially associated with academic or commercial campuses, and dedicated solar PV "farms." This could complement the heat and power sources with biogas CHP or biomass boilers as district energy and CHP become more widely deployed. To make a substantive and valuable contribution to reducing summer grid peak demand, PV needs to be deployed in large quantity. Traditionally PV initiatives have supported small individual installations with large subsidies. The rapidly dropping costs of PV (down over 10 percent since 2009) combined with the potential to reduce summer peaks is changing that equation. It is worth noting that the first net-metering law passed in Virginia in 2008, after a prominent member of the Virginia House of Delegates toured renewable energy projects Germany. Prices for solar arrays are dropping fast as manufacturing capacity ramps up worldwide and there are no obvious regulatory barriers to implementing solar PV solutions.

The 2007 Virginia Energy Plan also identified biofuels as a renewable energy source with some potential for application in Northern Virginia. In the two counties being studied, this would be more possible in Loudoun County with its relatively high concentration of agricultural and forestry waste than the more urban Arlington. As the Northern Virginia region grows, it will create larger quantities of municipal waste, which if appropriately separated for recycling, the energy recovery could be a profitable and environmentally friendly asset for both jurisdictions. Currently, approximately 3,000 tons of waste is co-generated per day at two facilities in Northern Virginia.[86] Germany's experiences with recycling and waste-to-energy in general, including Mannheim's experiences in particular, show recycling and waste-to-energy policies are mutually supportive. According to the OECD, between 1985 and 1999, recycling of glass and paper in Germany reached 81 and 73 percent, respectively.[87]

07

PROMOTING INNOVATION AND INVESTMENT

PROMOTING INNOVATION AND INVESTMENT THROUGH COMMUNITY ENERGY PLANNING

As awareness and interest in adopting a community approach to energy and climate concerns takes root in the U.S., cities and regions confront a consistent set of entrenched technical and policy challenges. If addressed effectively, as seems to be the case emerging in Loudoun and Arlington counties, these approaches offer opportunities to promote investment into the development and applications of new energy efficiency innovations and technologies in both countries. In addition to the development of more energy efficient buildings, these challenges include reconfiguring parts of the urban infrastructure in support of district energy systems along with the associated clean and renewable heating and cooling sources, transportation planning (especially rail), and deployment of renewable energies. Addressing these challenges offers opportunities for U.S. and German cities to cooperate through policy benchmarking and economic, technical, and academic exchanges. As the implementation accelerates, there will be many opportunities to develop long-lasting, high quality business relationships that would be mutually beneficial to both countries.

Restructuring Urban Infrastructure Planning for District Energy Systems

An argument heard in the U.S. against district energy systems is the level of upfront capital costs for the infrastructure, particularly in dense existing urban areas where there could be significant costs to tear open streets and to lay heating and cooling networks. The rate of deployment of district energy systems in U.S. urban regions could also be slowed because of the need to create economically viable "scale markets" for heating and cooling to offset initial capital costs. This often requires retrofitting buildings through the replacement of individual boilers and connecting to the district energy infrastructure. Complications increase with planning needed to assess and properly sequence building retrofits on a large scale. Last, but not least, there are a high number of non-owner occupied buildings in the U.S., where lease contract structures trend to mitigate against efficient and other energy upgrades. It is no easy task to pull together multiple building owners to coordinate large-scale building retrofits, the reconstruction of streets, and the potentially large-scale capital costs of placing infrastructure that may not be used at capacity for some period of time.

In addition to scale projects, the current water infrastructure crisis in the United States offers part of the solution to cost effective deployment of new energy infrastructure. Across the United States, the costs of segregating waste water from storm water systems (also referred to as combined sewer overflow) are staggering. In Washington, DC alone, it is estimated that between $1.4 and $1.6 billion is necessary to replace the pipes.[88] As cities such as Washington, DC (or Alexandria, Virginia) develop plans to transform their water infrastructure, there may be ideal opportunities to concurrently replace old and inefficient individual energy systems and deploy district energy infrastructure in selected neighborhoods. Cities could identify potential areas by concurrently mapping "district energy zones" that identify long-term combined sewer overflow replacements, building retrofits, and establishment of district energy systems. Cities could even consider building retrofits and deploying advanced cooling technologies around retrofitted water infrastructure, such as in Hamburg or Berlin.

Combined Heat and Power

Broadly speaking, CHP doubles the efficiency of fuel use through simultaneously generating useful heat and electricity. In the U.S. this is predominantly used by heavy industry, and the U.S. currently lags behind Germany in the development and implementation of large, medium, and small-scale CHP systems in the urban setting. Germany's urban planning policy framework has supported denser, mixed-use cities that are combined with national energy policies that financially support the development and application of large and micro-scale combined heat and power systems, particularly via the 2009 Renewable Heat Law. Germany has among the highest CHP share of district heating production in Europe, with approximately 84 percent of its total CHP serving district energy networks.[89] Although Germany lags behind other European countries in the production of electricity from cogeneration, is still outpaces the U.S. Currently, 8 percent of electricity in the U.S. emanates from cogeneration compared to 12 percent in Germany. By 2030, this trend is expected to widen with Germany targeting over 27 percent of electricity generation from cogeneration compared to approximately 18 percent in the U.S.[90]

Germany is making particularly strong efforts to include micro-CHP (under 10kW electric) within its overall energy framework. As a result of the economic support and financing of the Renewable Energy Sources Act, it is now estimated that Germany hosts 50 percent of all European companies developing micro-cogeneration solutions.[91] Although micro-cogeneration in Germany is still economically dependent on federal gas and electricity tax support and feed-in tariffs, it is starting to demonstrate some economic viability. By 2006, about 60MW of micro-CHP was installed in Germany, representing only 0.04 percent of electricity generation.[92] Without incentives, micro-CHP technology is not economically viable for most of the U.S. urban landscape; however, as mentioned earlier, this is a rapidly changing picture. Between now and 2015, applications of micro-CHP are expected to increase and this trend might accelerate as U.S. urban regions start to assume denser, mixed-use development and create more opportunities for effective use of heat.

Transportation Planning

The U.S. dependency on individual transportation built around cars powered by fossil fuels will remain an Achilles heel of U.S. energy policy for decades to come. Ewing et al. estimate that between 2005 and 2030, driving will increase by 59 percent in the U.S. They also note that sprawl development as currently practiced could alone lead to a 48 percent increase in the total miles driven over the same period.[93] This could outpace any gains from national vehicle efficiency or low-carbon fuels policies. U.S. cities endeavoring to find solutions to this dilemma can borrow from Germany's experience with integrated and mixed-use land use and transportation planning policies. U.S. metropolitan regions generally lack integrated and coordinated regional public transit services, including basic common-sense public amenities such as real-time signage, regionally coordinated timetables, on-light route locators, or even shelters. As a result, currently only 2 percent of all trips in the U.S. are made on public transit, compared to 8 percent in Germany.[94]

There are emerging changes. In 2008, when gasoline exceeded $4 per gallon, use of public transit in the U.S. rose 4 percent, reaching the highest level since 1956.[95] Even at its current relatively low level, public transit in the U.S. is a $54 billion industry with $36.4 billion in operating expenditures and $17.8 billion spent annually on capital investment. As U.S. cities such as Washington, DC and Arlington, Virginia, embrace deeper public transit options, German and American companies and communities stand to benefit. Redall reported that Siemens Inc., the U.S. arm of Siemens AG, already commands one-third of the U.S. market for manufacturing light rail cars.[96]

Some Americans are also seeking individual transportation alternatives including electric powered cars. The Obama administration targets one million 150-mile electric cars on U.S. roads by 2015.[97] The deployment of electric cars and fuel cell-powered automobiles in the U.S. will be stalled as long as infrastructure for recharging stations and battery replacement services remains limited. The Fuel Cell Partnership in California is demonstrating some signs of altering this. Formed in 1999, the "California Fuel Cell Partnership" is a unique collection of governmental regulators, local governments, and industry engaged in the development and application of fuel-cell technology. More than thirty partners of research institutes, bus manufacturers, and public transportation companies joined forces in an EU-financed project, where hydrogen buses, engines, and infrastructure such as maintenance and hydrogen fueling stations have been developed and field-tested under everyday bus fleet operation conditions in ten EU cities including Berlin and Hamburg. Realistically, the three short to medium-term technologies are likely to be petrol or diesel/electric hybrid, plug-in hybrids, and all-electric. The experiences of large-scale pilots in cities on both sides of the Atlantic should create fertile ground for shared experiences.

Renewable Energies

While the U.S. has made some progress in recent years to close the gap with Germany in the deployment of renewable electricity, mostly from wind, it still lags far behind Germany in terms of the share of overall generation. The gap is even wider in the development and application of solar and other renewable thermal energy sources and solar photovoltaic electricity generation. Both will be needed to deliver the breakthroughs called for in community energy plans of Loudoun and Arlington, and others. Due to support from the EEG, by 2009, Germany was the world's largest market for solar PV, generating over 3,075 GWh compared to 16 GWh in the U.S.[98] As a result, Germany is a major player in manufacturing PV around the world, either as a customer or as an investor and manufacturer. Recognizing the value for peak demand reduction, pollution prevention, and supporting local PV manufacturing, U.S. cities are becoming creative to compensate for the lack of federal policies such as consistent feed-in tariffs. As one example, in 2009, Gainesville, Florida, was the first U.S. city to institute a feed-in tariff system modeled after Germany's.[99]

Passive Housing (Net-Zero Energy Housing)

Nelson estimates that between 2010 and 2050, there will be 89 million new or replaced homes and 190 billion square feet of office and non-residential buildings constructed.[100] This represents two-thirds of all development that will be built between now and 2050. American buildings are generally far less efficient than their European equivalents, even allowing for lifestyle and climate differences. Community energy planning in the U.S. obviously calls for more efficient homes and buildings; usually targeting about a 50 to 60 percent overall gain within a couple of decades for new construction, and 30 to 50 percent gains for major renovation. To accelerate the overall community performance, they also could benefit from the deployment of passive housing for at least part of the new construction.

Originally developed in Germany, passive housing standards must not exceed primary energy demand of 120kWh/m^2 per year. Total heating energy is not to exceed 15 kWh/m^2 per year and total cooling energy is not to exceed 15kWh/m^2 per year.[101] Overall site energy must not exceed 50 kWh/m^2 per year. Germany leads the deployment of passive housing, with over 10,000 units built. While still a very small percentage of the total, it is not uncommon to find clusters of forty to fifty passive housing units in cities, such as Vauban and Freiburg. The strict energy standards of the passive home make it unlikely that U.S. urban regions will see scale development of passive housing soon and even less likely to see Passive Codes passed into building regulations. At the same time, U.S. cities may well learn some valuable lessons on construction costs, consumer acceptance, and infrastructure costs by creating small clusters of homes and service buildings conforming to the German passive housing standards.

08

STRENGTHENING THE TRANSFER OF EXPERIENCE

FORMAL INSTITUTIONAL SUPPORT: STRENGTHENING THE TRANSFER OF EXPERIENCE

Traditionally in the U.S., international activities are often viewed as interesting but marginal or irrelevant, resulting in limited integration of international lessons into domestic policymaking. International efforts by U.S. government agencies such as the U.S. Environmental Protection Agency, the U.S. Department of Energy, or Department of Housing and Urban Development, usually takes place in the context of overseas development assistance through bi-lateral assistance or through participation in multilateral organizations.[102] The one-way nature of these efforts has minimal domestic impact. It lacks systemic processes and established institutions that link domestic energy environmental policy challenges with solutions from abroad and vice-versa. For similar reasons, international work between sub-national governments (i.e., states, counties, and cities) is viewed even more suspiciously: as irrelevant or wasteful.[103] The overall lack of sharing is compounded by the lack of international structures within umbrella energy or urban planning organizations such as the U.S. Conference of Mayors, the National Association of Counties, or International City County Managers Association that focus on the identification and import of lessons from outside the U.S.

To change this at the national level, the formalization of the transfer and applications of community energy planning lessons through unilateral flows of technical and policy information would be a good place to start. This could be under the auspices of the State Department, managing two or three domestic energy programs and a dedicated exchange program with Germany. This could be a rational and immediate focus of a relatively small program under the Department of Energy's existing Energy Efficiency and Conservation Block Grant program, the National Science Foundation's Energy Regional Innovation Cluster, and three or four dedicated exchanges with the U.S. Fulbright Committee, maybe teamed with a respected academic center, many of which exist in the Washington, DC region. Baden-Württemberg is also home to the European Institute for Energy Research (EIFER) hosted at the University of Karlsruhe, which could make a logical choice for the other side of the conversation.

At the sub-national level, state or city officials and staff often lack time to find and review the complex information from abroad. Moreover, the technical information that they receive is often aged and inaccurate. All too often, it is also slanted for political or other reasons, and relatively meaningless without an understanding of the overall policy and market contexts.[104] Universities and technical consultants are very often well-versed in international energy, climate, planning, and benchmarking programs. However, they often lack formal access to the policy-making arena. Brought together, universities, technical consultants, NGOs, and key policy champions can transform the launch of problem-focused and goal-oriented policy transfers.

Finally, the transfer and adaptation of community energy planning experiences from Germany to the U.S. can benefit by drawing from the private sector, which often, out of necessity, must work within commercial networks and access and digest technical and policies from overseas. Northern Virginia serves as a microcosm of the opportunities but also the risks of neglecting this. The 2007 Virginia Energy Plan states that the Commonwealth lacked a policy infrastructure sufficient to lure and retain companies in the renewable energy production business—they went to Germany.[105] This was repeated in March 2008, when AES, a global producer of energy generation systems, announced a $1 billion investment in solar photovoltaic—in Germany.[106]

CONCLUSION

Cities and urban regions in the U.S. face enormous energy-related challenges over the coming decades. This is increasingly recognized by the local political leadership, but they are often operating in a state and federal context that fails to facilitate the breakthroughs needed fast enough. As U.S. cities and regions work to develop innovations to create competitive communities with low-carbon, high-quality economic development, and efficient affordable energy, they will need all the tools available. Drawing from successful experiences of pioneering countries such as Germany will be a major potential source of competitive advantage.

At the level of individual communities such as Loudoun and Arlington, there is a real possibility to team with the private sector, environmentalists, academic and policy leaders, and citizens at large from regions like Baden-Württemberg and cities like Mannheim, Heidelberg, and Stuttgart to create a mutually beneficial sharing of real world energy solutions. This short paper has tried to share some of the mechanics of community energy planning, how it has evolved in Germany, and how these lessons can be transferred to the U.S. via two case studies in Northern Virginia and the experiences in Baden-Württemberg. It has also tried to shed light on some of the economic, environmental, and social benefits that can emanate from the transfer of these lessons.

While Germany has been a clear pioneer in many aspects of urban energy efficiency, the contribution of similar pioneering work from Scandinavia, Switzerland, and other countries must not be overlooked. The coalescing of these multiple experiences in shaping the overall energy and climate strategy of the twenty-seven member European Union and affecting a population of 500 million may also provide some signposts how pioneering cities can ultimately cause continental scale change in policy and practice.

APPENDIX A

Key EU Energy Efficiency Policies, Organized by the CEP "Loading Order"

Directive on Common Rules for the Internal Market in Electricity (2003/43/EC) and Directive on Common Rules for the Internal Market in Gas (2003/55/EC)

Summary: In 1996 and 1998, the EU endeavored to diminish the monopolistic or oligopolistic holds over the national electricity and gas markets of member states by passing two separate directives that created wholesale and retail competitive markets. The electricity (1996/92/EC) and gas (1998/30/EC) directives, and their amendments from 2003, were created to establish common rules for the generation, transmission, and distribution of gas and electricity. The directives created operating and legislative guidelines for the organization and functioning of the electricity sector, market access, and procedures competing grants for operations of the systems.

Directive on Energy End-Use and Efficiency (Directive 2006/32/EC-"EuP")

Summary: The "EuP" Directive obligates member states to develop national energy efficiency plans that must attain 1 percent annual energy savings in the supply, distribution, and use of natural gas, electricity, and transportation fuels. The plans from the member states must aim to reduce final energy consumption 9 percent by 2015. The "EuP" Directive is intended to strengthen the energy performance of energy-using products in the residential and commercial sectors (except vehicles). The directive does not set binding requirements for individual products. The Directive defines conditions and criteria for establishing requirements on energy consumption for products such as heating and water equipment, electric motors, lighting, heating, air conditioning, and ventilation systems, before they are brought onto the market. The Directive calls on member states to report annually on their progress with implementing the Directive and the policy measures taken for implementation. The national plans are subject to final approval by the Commission. In many ways, the "EuP" Directive is an attempt to bring some aspects of Energy Services market place toward a structured framework similar to utilities.

Directive on Building Performance including Energy Performance Labels (Directive 2002/91/EC, "EPBD")

Summary: The Directive entered into force on January 2003. The objective of the EPBD is to improve energy efficiency of new buildings and buildings to be retrofitted. All buildings must regularly update their total energy consumption and greenhouse gas performance and make this available via a simply understood performance label at the time of sale or lease. In addition, buildings greater than 1,000m^2 regularly used by the public, must display a current label in clear view. The Directive requires member states to: 1) develop a standard methodology to calculate the integrated performance of buildings; 2) set minimum energy standards in new and existing buildings; 3) create energy certificates for buildings; and 4) establish an inspection and assessment of heating and cooling systems. The specific methodologies for the calculations were left to the individual member states, but were to include heating, cooling, heat recovery, and lighting. Inspections of heating and cooling systems older than fifteen years also were mandated in the Directive. For buildings that are constructed, sold, or rented, an energy performance label must be available. The label must list information about energy ratings and efficiencies that could be readily achieved. In 2008, the EPBD was revised by removing the 1,000m^2 threshold for national minimum energy performance requirements.

Key EU Renewable Energy Policies

Directive on the Promotion of the Use of Energy from Renewable Sources of Energy (Directive 2009/28/EC)

Summary: The Directive creates a common framework to the deployment of renewable energies by 2020. Each member state has a target calculated according to the share from renewable sources in its gross final consumption for 2020. The share of energy from renewable sources in the transport sector must be at least 10 percent of final energy consumption in the transportation sector by 2020. Each member state must establish a national action plan with targets for renewable energies. The national plans also are to contain procedures that outline the planning and pricing schemes and access to electricity networks that support renewable energies. The plans must call for the member states to ensure that operators guarantee the transport and distribution of electricity from renewable energies.

Directive on Promotion of the Use of Biofuels or Other Renewable Fuels for Transport (Directive 2003/30/EC)

Summary: This Directive established indicative targets for minimum proportions of biofuels in the fuel market. The implementation of this Directive supports the Europe-wide market introduction of biofuels and is to create new markets for agricultural raw materials and contribute to additional emission reductions in the transport sector. As in the U.S., there is debate over the acceptable sources of renewable biofuels to ensure this does not encourage inappropriate agricultural practices.

Key EU Heat Recovery Policies

Directive on the Promotion of Cogeneration Based on a Useful Heat Demand in the Internal Market (Directive 2004/8/EC)

Summary: The Directive entered into force in February 2004 and obligated member states to undertake assessments of cogeneration production and distribution. Member states must ensure the guarantee of origin of the electricity, which enables producers to demonstrate that the electricity they sell is produced from high-efficiency cogeneration. A guarantee of origin must specify the lower calorific value of the fuel source from which the electricity was produced and specify the use of the heat generated together with the electricity and the dates of production. The overall target is for cogeneration applications to achieve at least 70 percent overall fuel efficiency from the combination of heat and power generation.

Key EU Climate Policies

Directive for Greenhouse Gas Emission Allowance Trading (Directive 2003/87/EC)

Summary: The European Emissions Trading System is the EU's framework to control and monitor greenhouse gas emissions flexibly and efficiently in the absence of command-and-control regulatory instruments. It codifies the allowed emissions trading mechanism of the Kyoto Protocol in the EU's response to its agreed targets into the national polices of each member state. The initial terms of the directive in 2005 covered approximately 12,000 energy and industrial installations and represented approximately 40 percent of the EU's emissions. Starting January 2005, emissions "allowances" equaling one ton of CO_2 were allocated within the context of "national allocation plans" by member states. With the final approval of the European Commission, member states determine the number of allowances individual installations were to receive, creating the "scarcity" to drive market forces and value. Limits to national-level emissions were developed by each individual country. Allowances were traded within three separate phases (Phase 1, 2005-2007; Phase 2, 2008-2012; and Phase 3, 2012 to 2020). Under the terms of the first trading period, there was an over-allocation of allowances and the devaluation of the price of carbon. Under corrections made in 2008, a centralized allocation process was developed. Proceeds from the allowances are invested in national mitigation plans.

Key EU Spatial Planning and Urban Development Policies

Summary: There are no specific EU Directives related to spatial planning and urban development, particularly as they relate to integrated transportation and land-use planning. The European Spatial Development Prospective of 1999 was an effort to development recommendations and proposals for coordinated spatial planning that balanced economic development. The "Railways Directive" (Directive 91/440/EEC, Development of Community's Railways) was part of a suite of directives aimed at opening the rail freight market and clarifying the formal relationship between state and infrastructure manager and railway operators and the train operators. In a similar way, the EU has a range of Directives aimed at encouraging the transfer of freight to the 30,000 km of canals and river waterways to minimize the energy and pollution impact. About 40 percent of intra-EU freight moves on short shipping coastal and inland waterways. The 2005 "Harmonized Information Services Directive" requires member states to ensure the ready availability of information on waterborne freight options.

EU Energy and Administration and Policy Development Processes

Summary: Internal EU energy policies have evolved through a comprehensive and consensus-driven process. Usually this has involved the Commission acting upon a request by the relevant Council of Ministers, or by the European Parliament for draft legislation through a process that includes consultations, and "White" or "Green" papers. The draft legislation is reviewed by the Parliament and the Council of Ministers, both of which are free to add amendments. On energy policies, the Council of Ministers can approve with a qualified majority. The Parliament can only reject proposals with an absolute majority. Policies involving fiscal measures or the structure of national energy supplies require total unanimity in the Council of Ministers, but just the consultation of the Parliament. The EU has traditionally had slower than expected progress in de-regulating the energy supply sector due to member state concerns about supply infrastructure as well as the EU's challenges with taxation.[107] However, energy and environmental policy development has migrated toward an EU-wide approach under consistent pressure from Brussels. In general, EU policy is structured to be mindful of the role of national governments and their sub-national actors, particularly when dealing with land-use planning and taxation. The concept of "subsidiarity" is the recognized guiding principle. This recognizes the freedom of action for local and regional authorities—especially in the realm of land-use,[108] except where it can be clearly demonstrated that an EU-wide approach will be necessary to develop the policy aims of the Council of Ministers.

APPENDIX B

Key German Energy Efficiency Policies, Organized by the CEP "Loading Order"

German Building Energy Conservation Act and the Energy Ordinance (Energieeinsparungsgesetz, EnEG and Energieeinsparverordnung, EnEV)

Summary: The 2002 EnEG (amended in 2007 and 2009) and the EnEV reflect Germany's efforts to meet the obligations of the European Directive for Building Performance (EBPD). The EnEG and the EnEV collectively require building owners to apply a standardized methodology calculating primary energy demand per square meter. They also call for the issuance of energy certificates that reflect calculated energy demand per square meter for new and some classes of retrofitted buildings. This has been unified under the EnEV 2009. The German calculation method is according to the German Standards Institute (*Deutsches Institut für Normung*, DIN). The method is a holistic assessment of the building's thermal shell, lighting installation, and appliances for heating, ventilation cooling, and hot water. In Germany, the billing of heating cost on the basis of metered consumption has been mandatory for buildings with more than two units as stipulated by the Heating Cost Ordinance (*Heizkostenverordnung*, HeizkostenV 2009). The metered data must be standardized to fit into standard climatic conditions by using the ratio of degree-days for the local and standard climate. There are two forms of energy certificates (*Energieausweis*): The *Verbrauchsausweis* (consumption certificate) lists consumption of energy during last three years and basic facts of the building and requires no site visit/audit. The *Bedarfsausweis* (demand certificate) requires an audit for heating systems and total energy demands. The 2009 amendments to the EnEV call for a 30 percent increase of energy efficiency standards for new and existing buildings, with another increase of 30 percent planned for 2012. The approved amendments also call for a phase-out of electrical heating. The EnEG and the EnEV work in tandem with the German Statutory Code on Building and Construction (*Bundesbaugesetz*), which sets the framework for construction and development polices in Germany. To complement the EnEV, the German federal government has created the Building Renovation Program (KfW CO_2 *Gebäudesanierungsprogramm*). In 2007, the *Kreditanstalt für Wiederaufbau* (KfW), a government-owned development bank that issues loans to small and medium-sized companies, made available €1.5 billion for the period 2007-2011 to support implementation of residential building retrofits under the EnEG and the EnEV. Loans up to €50,000 for thirty years with 1 percent interest are made available to private homeowners, housing companies, local authorities and municipal associations, and other public corporations such as churches, foundations, or associations.

Key German Heat Recovery Policies

German Renewable Energies Heat Act (EEWärmegesetz)

Summary: In June, 2008, the German government approved the Renewable Energies Heat Act (*Erneuerbare-Energien-Wärme-Gesetz*, EEWärmeG). The EEWärmeG was designed to increase the production and distribution of heating via renewable energies (geothermal, solar, biomass, ambient heat) and to encourage retrofitting of residential and commercial sectors in ways that accommodated heat via renewable energies. The target of the law is an increase of the national percentage of heat for residential and commercial space from approximately 7 percent in 2009 to 14 percent by 2020. The law applies to all residential and commercial structures built after 2009. Owners of commercial and residential buildings built after 2009 must supply heat from any of the sources in the following percentages: 1) solar thermal: 15 percent; 2) biomass: 30 percent, or 3) geothermal, biofuels, solid biomass, and ambient heat: 50 percent. The law outlines a range of technical specifications and considerations of seasonal variations in temperature performance factors (such as floor space for solar thermal panels). As an alternative choice to renewable heat, the law recognizes and supports cogeneration and district heating as "alternative measures." Owners of buildings can draw from waste heat, combined heat and power plants, and connection to district heating grids, as long as they exceed the Energy Saving Ordnance by an additional 15 percent. To assist with building retrofits and the deployment of biogas, solar thermal, and wood-chip furnaces, the federal government made available €500 million (*Marktanreizprogramm*). Additional funds may be tapped to building retrofits via proceeds from tax revenue surpluses from the emissions trading.

German Combined Heat and Power Act (Kraft-Wärme-Kopplungsgesetz, KWKG)

Summary: The prominence of cogeneration is evident in its standing as the first theme of the Meseberg Declaration. The target of the Combined Heat and Power Act (*Kraft-Wärme-Kopplungsgesetz*, KWKG) in its current 2009 version is to increase the national-level share of electricity produced by combined heat and power to 25 percent by 2020. The law also intends to promote the construction of small CHP units. Operators of CHP plants are entitled to a payment of a surcharge when they feed CHP electricity into the grid. Grid operators are obliged to connect CHP plants to their grid and to accept the electricity generated in these plants, and are allowed to distribute the cost for the surcharge forward to the electricity customer by an incremental CHP tariff component (€0.025/kWh up to €0.13/kWh), resulting in a less than 1 percent electricity price increase. Since 1 January 2009, remuneration to operators is "capacity-dependent." Germany's 21 GWe installed cogeneration capacity is the largest in Europe (in absolute capacity) and could produce as much as 50 percent of Germany's electricity by 2050 (from 12.5 percent today). The law also adopted many of the elements of the feed-in tariffs, in which the premium's value decreased over time. There are other support schemes in the form of investment subsidies or special loans with lower interest rates. There are also support mechanisms for units within the CO_2 building improvement programs. In addition, there are other support schemes in the form of investment subsidies or special loans with lower interest rates. There are over 11,416 CHP plants in Germany.[109] €750 million per year (from Climate Package) is to be made available by the federal government for production of electricity by CHP construction and modernization of heating networks. The amendments of the EEG treat the feeds of EEG and KWKG equally.

For CHP plants connected before 2009, the following surcharges are paid (in Eurocent per kWh)[110]

Plant Type	In 2008	In 2009	In 2010	2011
"New" existing plants (commissioned after 1 January 1990 but before 31 March 2002)	.82	.56		
Modernized plants ("old" plants, rehabilitated and re-commissioned between 1 April 2002 and 31 Decembr 2005)	1.64	1.59	1.59	
New small CHP plants (commissioned between 1 April 2002 and 31 December 2008)	2.1	2.1	1.94	
New small CHP plants up to 50kW (commissioned between 1 Apirl 2002 and 31 December 2008)	5.11 (for a 10 year period from start of continuous operation)			
New Fuel Cell plants (commissioned between 1 April 2002 and 31 December 2008)	5.11 (for a 10 year period from start of continuous operation)			

CHP Plants Commissioned after 1 January 2009 are supported as follows (in Eurocent per kWh)[111]

	CHP Surcharges Paid (Eurocent / kWh)	**Maximum Supported Period (in years)**	**Maximum Supported Full Capacity Operation Hours (FCOH)**
Fuel Cell Plants (commissioned between January 2009 and December 2016)	5.11	10	
New Small CHP Plants Up to 50 kW (commissioned between 1 January 2009 and 31 December 2016)	5.11	10	
New CHP Plants 50kW-2MW (commissioned between 1 January 2009 and 31 December 2016)	2.1	6	30,000 FCOH
New CHP Plants More than 2MW (commissioned between 1 January 2009 and 31 December 2016)	1.5	6	30,000 FCOH
Modernized CHP Plants (commissioned between 1 January 2009 and 31 December 2016)	According to the corresponding stipulations for new plants		

Key German Renewable Energy (RE) Policies

German Federal Electricity Feed Law (Stromeinspeisegesetz, StrEG) and the German Renewable Energy Act and Amendments (Erneuerbare-Energien-Gesetz, EEG)

Summary: Approved in 1990, the StrEG obligated public utilities to purchase renewable-generated power from wind, solar, biomass, and landfill gas sources on a yearly fixed-rate basis, based on utilities' average revenue per kWh. Remuneration to wind producers was set at 90 percent of the average retail electricity rate, for other renewable power providers, compensation was set at 65-80 percent, depending on plant size, with smaller plants receiving the higher subsidy. The StrEG effectively subsidized the operation of commercial wind installations at €.041/kWh and jump-started wind power. The StrEG was followed by Germany's Renewable Energy Law (EEG), in 2000. The goal of the EEG was to double renewable energy share in power generation fuel mix by 2010 to a minimum of 12.5 percent. Unlike the StrEG, the EEG's remuneration system is not based on average utility revenue per kWh sold, but rather on a fixed, regressive feed-in tariff for renewable sources. Low-cost renewable energy producers are compensated at lower rates than higher cost producers, providing strong incentives for the development and operation of renewable energy installations on lower-quality sites.

Also under the EEG, grid operators are obligated to purchase power from local producers and a nationwide equalization scheme has been implemented to reduce the cost differentials paid by grid operators in different parts of the country for the purchase of renewable-generated electricity. The EEG also increased rates utilities pay to renewable energy producers, in most cases by 10 percent. The Renewable Energy Supply Act subsidized most renewable energy sources and obligated utilities to buy power from renewable producers, but succeeded mainly in promoting wind, while solar PV and solar thermal energy deployment grew more slowly,[112] even though the financial support to support PV received one of the highest share of the budget. The EEG was amended in 2004 and gave added emphasis on biomass (broadly defined, but from agricultural and forestry operations, industrial waste and municipalities). A target in 2004 was to increase the share of renewables in power generation in Germany to 12.5 percent by 2010. The target has been extended to 14 percent. For small-scale plants (up to 150kW) which use renewable sources the initial subsidy was €.215/kWh, more than hydro or wind.

The guaranteed feed-in tariff approach of Germany's EEG is considered a global model for the promotion of renewable energies. More than forty countries (eighteen within the EU alone) have adopted it as a template for their own renewable energy.[113] However, it should be noted that some experiences with the adoption of the feed-in tariff were not totally successful. Under the "quota model" the state set certain quotas for renewable energies to be produced by the suppliers, and verified by submitting certificates for RE generation, which can be traded between suppliers to fulfill their quota. In tendering approaches, a certain amount of RE generation is tendered and the best bidder is awarded with a (limited) purchase guarantee at the tendered price. But models prove less successful in comparative analysis.[114] In countries using these approaches, the RE industry is weak, because there is little investment security and RE costs are relatively high as the investment risk is added to the prices (such as in the UK and Italy). Therefore, several countries, such as Ireland, have switched to guaranteed feed-in tariff models.

Key German Spatial Planning, Urban Development, and Transportation Policies

Summary: In Germany, planning and open space protection policy is characterized by the "countercurrent principle" (*Gegenstromprinzip*), a top-down and bottom-up policy process in which the federal government and individual German states (*Länder*) coordinate spatial planning.[115] Although ultimate authority controlling the details of open space protection rests with the states and their local authorities (via development of land-use and master plans—*Flächennutzungspläne* and *Bebauungspläne*), the German constitution empowers the federal government to develop framework laws in which basic parameters for land-use, transportation, and nature protection are established. In the context of these framework laws, the German federal government prescribes basic guidelines for state and local open space planning. Each individual German state is obligated to fill in the legislative details and oversee enforcement of land-use plans down to the local level.[116] The Federal Nature Protection Law (*Bundesnaturschutzgesetz*) and federal spatial planning law (*Raumordnungsgesetz*) compel the sixteen individual German states to identify, classify, and establish protected areas via state-level land-use plans (*Landschaftspläne*) which are integrated into broader national planning processes. This broader planning process is coordinated between the federal government and individual states.[117] The guidelines demand a system of boundaries around urban centers by compelling states to prepare a large-scale and integrative system of open space plans in advance of all new development—including well-defined greenbelts.[118]

German Energy Policy Framework Process

Like the U.S., Germany is a federal republic with a distribution of executive, legislative, and judicial powers. Historically, the environment, energy, and urban development authorities have been delegated to the sixteen individual states but in the context of a carefully integrated and coordinated dialogue between EU, federal, state, regional, and local authorities. Typically, German federal governmental policy sets framework laws and targets (*Rahmengesetze*), which the individual states must implement. National laws such as regional planning and building (*Raumplanungsgesetz* and *Bundesbaugesetz*) and climate policies (*Integriertes Energie- und Klima Programm*) evolve within top-down and bottom-up dialogues between all levels of national and subnational authorities. This pattern has been consistent, even as climate and energy policies have tended to become centralized within the context of EU-led directives.[119] The EU can be understood as another level in this pattern above the national level, coordinating and setting a supranational framework for Germany as an EU member state.

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