AICGS ISSUEBRIEF

DECEMBER 2008

29

Climate and Energy Policies in the United States and Germany: Lessons for the Future

BY TIM STUCHTEY AND KIRSTEN VERCLAS

What can we learn from our emissions trading systems?

What policy instruments have been successful in Germany with regard to bioenergy?

What changes should Americans and Germans make in the building and transportation sectors to help mitigate the effects of climate change?

Few people still doubt that human behavior has an impact on the world's climate. The burning of fossil fuels and the related emission of carbon dioxide (CO_2) and other greenhouse gases leads to global warming—with potentially huge effects on flora and fauna and ultimately on the way we live. In order to lessen these effects politicians, researchers, environmentalists, and business people around the world are discussing policies and methods to mitigate climate change.

The American Institute for Contemporary German Studies (AICGS) has long been a part of this discussion, adding to the debate its unique perspective with comparative studies about Germany and the United States. As in many other fields, some of the approaches differ across the Atlantic for reasons which might be more cultural than political in nature. In Germany, policies primarily target the demand side—the energy consumer—using the price mechanism to make energy more expensive. Prohibitions and imperatives are used more frequently in Germany, in particular for consumers. In the United States, policies are more directed toward the supply side. With a core belief in the creativity of mankind—as well as the potential of American researchers and their institutions—U.S. policies seek to spur technological progress that either develops new sources of affordable energy or products that use significantly less energy. Oversimplifying, one could say that Germans have acknowledged that everyone's way of life must change in order to cope with the challenge of climate change, even though this sometimes leads to costly policies with questionable environmental impact (i.e., the household recycling system), while Americans are less willing to change their way of life and instead seek new, affordable energy technologies to ensure that they do not have to do so.

With the generous support of the *Daimler-Fonds im Stifterverband für die Deutsche Wissenschaft*, AICGS completed a project to address this challenge and to provide a range of viable transatlantic solutions. At the center of the project are three Policy Reports covering the following topics:

■ AICGS Policy Report 35: *Climate Change and Energy Security: Lessons Learned*, by Joseph E. Aldy, Camilla Bausch, and Michael Mehling

This Policy Report draws on the experiences in Germany and the U.S. with regard to their climate and energy policies and includes an examination of the key actors in politics and the economy on both sides of the Atlantic.

■ AICGS Policy Report 36: *Bioenergy in the United States and Germany*, by Bruce A. McCarl and Tobias Plieninger

The second Policy Report focuses on the role biofuels can play in addressing climate change and improving energy security. Opportunities for German-American cooperation in this extremely important sector are also explored.

■ AICGS Policy Report 37: *The Short-Term Potential of Climate-Friendly Technologies*, by Felix Chr. Matthes and Lewis J. Perelman

The final Policy Report looks at technological solutions that can make a substantial impact on climate protection and energy security today or in the near future. The crucial roles of energy efficiency and intelligent energy use are investigated for both Germany and the United States.

Each Policy Report is co-authored by a German and an American author, who then presented their work at a climate and energy conference organized by AICGS in cooperation with the Center for Clean Air Policy (CCAP) on 17 November 2008. The authors of this Issue Brief summarize the event and the Policy Reports from their perspectives and try to draw some policy recommendations out of these comparative studies. Looking first at the European Union's Emission Trading System (EU ETS) and the various regional attempts in the U.S. for a cap-and-trade system in the section on *Climate Change and Energy Security: Lessons Learned*, this Issue Brief then examines the potential of biofuels and the effects that the policies targeting them had on other markets. In the third section this paper studies the near-term potential of climate-friendly technologies that are currently available. The Issue Brief concludes by drawing some political implications from the key findings.

Climate Change and Energy Security: Lessons Learned

The EU's Emission Trading System

As it becomes generally accepted that human behavior—and in particular the burning of fossil energy—has an impact on the earth's climate, policymakers on both sides of the Atlantic are thinking about measures that limit our impact on the global climate. Global warming will—or might already—affect our welfare and well-being, though the effects will be felt differently across regions.

The Intergovernmental Panel on Climate Change (IPCC) estimated in 2007 that without further action the average global temperature will rise by 4°C by 2100. Such a rise would have a major impact on our way of living and on our societies. The Kyoto Protocol to the United Nations Framework Convention on Climate Change (UNFCCC) was a first step in addressing the serious global threat of climate change. The ultimate goal of the UNFCCC is to stabilize atmospheric concentrations of greenhouse gases at a level that prevents dangerous human interference with the climate system. In accordance with the findings of the IPCC and others, the worldwide emissions of greenhouse gases will need to be reduced to well below 1990 levels in order to meet this goal. The European Union, as part of the Kyoto Protocol, therefore agreed to reduce greenhouse gas emissions by 8 percent below 1990 levels to keep climate change to a manageable level and to allow a rise of the average global temperature of no more than 2°C. Policy measures should aim at avoiding any rise above this level.

In their latest attempt to reach their target, the EU has put forward the objective of a 30 percent reduction in greenhouse gas emissions (GHG) by developed countries by 2020 (compared to 1990 levels) in the context of the international negotiations for a post-Kyoto agreement. With this target the EU thinks it can ensure that the world stays within the 2°C limit. Until an international agreement is concluded, and without prejudice to its position in international negotiations, the EU will take on an independent commitment to achieve at least a 20 percent reduction of GHG emissions by 2020 through the EU emission trading scheme and other climate change policies in the context of energy policy. In line with this EU Energy Policy, the following further actions will aim to significantly reduce GHG emissions in the EU by 2020:[1]

■ Improve the EU's energy efficiency by 20 percent by 2020;

■ Increase the share of renewable energy to 20 percent by 2020; and

■ Increase the share of biofuels in transport fuel to 10 percent.

These targets set by the EU Council are referred to as the "20/20/20 targets."

As its most important tool to achieve the reduction of GHG emissions, the European Union developed the Emission Trading Scheme to integrate external climate effects into the price mechanism for energy and to reduce the amount of emissions to a sustainable level. Although long discussed in the academic literature, the EU ETS is the first international attempt to turn the global common air/climate into a good that has a price. Those who use it by emitting, for example, carbon monoxide into the air have to pay a price and will therefore take polluting the air into their economic consideration.

The EU ETS started 1 January 2005. Operators of energy or industry installations within the EU are obliged to participate in the trading regime. They represent around half of all CO_2 emissions in Europe. Installations that fall under the EU ETS regime need to have enough CO_2 certificates to cover their emissions within each year. These certificates can be transferred among market participants and therefore have a price that is determined on an exchange market.

In the beginning, member states were quite free to decide how to allocate the pollution certificates among the market participants. The EU ETS is divided into trading periods with a review process that allows for changes within the system. The first trading period occured from 2005 to 2007; the second will run from 2008 until

2012. After the EU ETS has been in place for four years, an evaluation will determine which lessons can be learned from its existence so far. Additionally, as the discussion about climate change and the reduction of the dependency on foreign energy sources will regain strength under a new U.S. administration, this should also include a determination of whether this tool is worth being implemented in the U.S.

Although the EU ETS is seen today as a success, it experienced a significant setback in its second year of operation. While the price for a certificate was quite stable at the beginning of trading, the price dropped from €32 to below €10 in only weeks in spring 2006 due to an excess supply of pollution certificates in the initial phase, combined with asymmetric and insufficient information of the market participants and regulators. This volatility had a devastating effect on confidence for this new market. As a consequence, the member states were forced to significantly reduce the emission cap within their National Allocation Plans (NAPs) in the second trading period. The quality and quantity of information available for market participants has also improved; consequently, the price per ton carbon has been stable since the beginning of the second trading period.

Another lesson that can be learned from the European experience is that not only the quantity but also the allocation method matters greatly. Auctioning the rights to pollute might pose a cost burden on polluters that finally leads to higher prices for consumers, but so does passing out the certificates for free. The difference is that that the former generates revenue for the state while the latter causes windfall profits for the polluters.

As of today, the EU ETS can be described as a success in the making. It has already established the largest market for an environmental commodity (i.e., carbon) in history. It has also shown that the specific regulations for the allocation and trading process matter greatly. Furthermore, targets are very important as a robust incentive framework. Such a framework provides legal certainty for long-term investment planning and the incentives for technology transfer into the market place. Legally binding targets also work as a strong political signal. Yet, not all targets are a success; some EU member states are not on track to comply with their reduction quota for the Kyoto target. Current and future challenges facing the EU include the difficult political and economic environment in 2009—e.g., the financial crisis and the EU parliamentary elections, to name just a few—controversies between member states over burden-sharing, and the uncertainty of achieving the existing targets, both of which could undercut European credibility in international negotiations.

To avoid this, the Commission released a proposal in early 2008 which would fundamentally change the EU ETS. The Commission proposes to:

- expand the scope of the EU ETS;
- centralize much of its management with the Commission;
- allocate a much bigger number of certificates through auctioning;
- include importers of energy-intensive products into the system;
- expand the coverage of the system to other pollutants; and
- integrate industries that, up until now, have been exempt.

Germany, who has long been a driving force for the EU's climate policy, has recently experienced a growing debate about its commitments to the international climate regime. The current recession has some minister presidents from German *Länder* (states) demanding a loosening of the targets. They argue that stiff targets would jeopardize additional jobs in a situation when unemployment is already on the rise. The upcoming federal election in September 2009 will most likely focus on jobs; the economic situation in Germany is unlikely to improve until the new government is in office. That the Czech Republic will hold the presidency of the EU in the first half of 2009 seems to be an additional burden for the road to Copenhagen. The Czech president is known to be skeptical about an ambitious climate policy, making it less likely that he will put this on top of the agenda.

Looking Beyond the U.S. Federal Government

Internationally—and particularly in Europe—the U.S. is widely seen as a nation with the biggest per capita carbon footprint that refuses to take action against climate change by not passing the Kyoto Protocol. While other industrialized countries are trying to lower their CO_2 emissions, forecasts indicate that under a "business as usual" scenario U.S. emissions will continue to rise by 7 percent between 2007 and 2020. Yet, looking beyond the federal government's inaction, one finds a variety of activities in this field on the state level in the U.S. Therefore, while overall emissions did rise over the last thirty years, the CO_2 emitted per unit of output has decreased by half.[2] "The lack of federal action does not represent a consensus view among the American public or their representatives on the state level."[3]

As in many policy fields, the states are laboratories for innovative policies. In a true competition of ideas, the federal system generally allows for experiments that help the U.S. to implement policies on the national level that have proven to be effective and efficient. In the field of climate policy, at least seventeen states have already set emission targets, often in line with the Kyoto Protocol, ignoring the federal decision not to take part in this international regime. Some states (CA, FL, NM, OR, MA, and VT) even set ambitious long-term targets to reduce emissions up to 85 percent below 1990 levels by 2050. Regional cap-and-trade programs have been implemented to reach these goals in addition to renewable portfolio standards and energy efficiency programs, all of which are quite similar to the EU policies described above.

The states, when implementing their programs, took into account the experience with the EU ETS and its regulatory flaws, in particular regarding the cap-and-trade programs. For example, the Regional Greenhouse Gas Initiative (RGGI) of some northeastern

states is regulating not on the industrial user level, as does the EU, but at the emission source. It covers all fossil fuel power plants with a production capacity of at least 25 megawatts. The RGGI also allocates emission certificates through an auction.

The Renewable Portfolio Standards require electricity providers to produce a certain percentage of electricity with a set of defined renewable generation technologies. This policy triggered the creation of renewable energy credit markets on which those companies with difficulties reaching a set target can buy credits from companies that exceed the target. As in Europe, however, critics allege that renewable standards are often not the most cost effective way to reduce CO_2 emissions, when more can be achieved by switching from coal-fired plants to natural gas, which produces only half as much CO_2 per unit electricity, for example.

The Energy Efficiency Programs of the past have done little to change the fact that Americans use twice as much energy per capita as Germans while their GNP per capita is only around 20 percent higher.[4] Recently, however, California's requirements for automobile fuel economy have gained a lot of attention recently. The state requires 30 percent lower greenhouse gas emission by 2016 which would result in 36 miles per gallon or 6.5 liters per 100 kilometers. However, in order for California to implement this ambitious policy, the Environmental Protection Agency (EPA) needed to issue the state a waiver for surpassing federal policy, which was denied.

All of the action on the state level, however, cannot substitute for a federal policy. Despite the lack of a coherent policy, policy decisions by the states have finally begun to inform the debate in Congress as well. Following the abridged Congressional discussion on the Lieberman-Warner bill, some Democrats produced a letter outlining several issues; this letter could become a road map for future cap-and-trade legislation. In it, they detail that each piece of legislation needs to:

- define the scope and leverage of legislation;
- address the extent of action and of free allocation, as well as who will receive the proceeds;
- include a provision to contain costs to prevent undermining the political will; and
- ensure the competitiveness of participating nations.

It remains to be seen whether the new administration, taking office during economically challenging times, will stick to its campaign promise to turn the U.S. into an international leader in climate policy and what role the administration can play in shaping the post-Kyoto regime.

Bioenergy in the United States and Germany

One politically-controversial technological fix to the problem of climate change and energy security is bioenergy. Initially heralded as the most promising weapon against the increase in emissions, it has come under scrutiny in the past few years as food prices have increased and potential adverse side effects of agriculture designed to support bioenergy have become more apparent.

Germany

The bioenergy market in Germany was established completely on the basis of policy initiatives and is not the result of free-market based innovation. That means that currently only subsidies and tax breaks allow for the market to operate profitably. The reputation of bioenergy as a renewable, climate-friendly energy source capable of guaranteeing a state's energy independence has been the basis of this policy push to establish bioenergy in Germany. Three main policy instruments have been used in Germany and Europe to foster bioenergy: Guaranteed feed-in remuneration, minimum quotas for bioenergy use, and subsidies and tax breaks.[5] These instruments are anchored in the Renewable Energy Sources Act (*Erneuerbare Energien-Gesetz*) in Germany. Additionally, the Biofuels Quota Act (*Biokraftstoff Quotengesetz*), implemented in 2007, requires a quota of biofuels to be included with fossil fuel in the production of gas and diesel. This law replaced a tax exemption for biofuels and biofuel mixtures, which proved so successful that the German government decided to abolish this incentive as it was hurting tax revenues considerably. Interestingly, the repeal of the tax exemption for biofuel plunged the biofuels industry in Germany into crisis, underlining the importance of policy incentives for the profitability of the biofuels market in Germany. The success of the tax exemption has also caused most biofuels to be funneled into the transportation sector, leaving the supply of heat—which would be one of the more intuitive applications of bioenergy—underdeveloped and lacking in policy incentives. The only policy measure pertaining to bioenergy and heat supply is the Market Launch Program (*Markteinführungsprogramm*), which uses part of Germany's eco-tax to encourage the installation of biomass heater facilities in buildings. The federal government has also suggested a law which would require new houses to comply with a minimum quota of renewable energy use or, alternatively, employ energy savings practices.

In assessing German policies designed to increase the use of biofuels, several critical points can be observed. The fragmentation of policies that target each sector separately often leads to a misallocation of bioenergy, with most of it going into the transportation sector, as mentioned above. Additionally, implementing targets for biofuels neglects the question of efficiency and an economic cost/benefit analysis is lacking. Furthermore, the recent debate about biofuels increasing global food prices has raised further critiques of German policies. The Science Council for Global Environmental Changes of the German Government (*Wissenschaftlicher Beirat der Bundesregierung für Globale Umweltveränderungen*) stated in a report in December 2008 that the support of biofuel without regard to consequences such as the rise in food prices or increasing deforestation of the rainforest

should be stopped. Rather than increasing incentives for biofuels as an alternative to fossil fuel, the Council stated, Germany should focus on the heat supply possibilities through bioenergy. While the German government has started to take such critique into account by discussing environmental minimum standards for biofuels, this can only be the beginning of a more substantial debate in Germany about the best use of bioenergy.

United States

The United States first became interested in the possibility of using bioenergy to replace fossil fuels during the energy crisis in the 1970s, as did other states around the world. A U.S. ethanol program supported by subsidies was launched and codified in the Energy Policy Act of 1978. While that program continued to exist, the stabilization of oil prices in the subsequent decades prevented any deeper interest until energy prices began to soar again in the beginning of the twenty-first century. Even though the Clean Air Act of 1990, which required gas to have a minimum oxygen percentage, intended to boost biofuels—in particular ethanol—the cheaper methyl tertiary butyl ether (MTBE) was used instead of ethanol or any other biofuel. Only when concerns about MTBE's health and environmental risks led to a ban of the substance in the early 2000s did ethanol production increase significantly.

As in Germany, this example underscores not only the difficulty of avoiding negative side effects with energy and environmental policies, but it also highlights the fact that ethanol and other biofuels are highly dependent on policy initiatives and incentives in order to become profitable, as more cost-effective, albeit perhaps less safe or environmentally friendly, energy alternatives are still available. The Energy Policy Act amending the Clean Air Act in 2005 then put a concrete emphasis on renewable fuels with the Renewable Fuel Standard Program, which mandated gasoline to have a certain amount of renewable fuel. This law was subsequently expanded by the Energy Independence and Security Act (EISA) in 2007. In 2006 the U.S. surpassed Brazil as the global leader in ethanol production and "[b]ioenergy [currently] ranks second (to hydropower) in renewable U.S. primary energy production and accounts for three percent of the primary energy production in the United States."[6] Additionally, "[b]iofuels currently account for roughly 5 percent of overall transportation fuel use in the United States, and the use of biofuels is scheduled to reach 36 billion gallons by 2022 under the EISA Renewable Fuels Standard."[7]

In the U.S., several executive departments and agencies are involved in bioenergy policy and its implementation. Apart from the legislative branch, the Department of Energy, the Department of Agriculture, and the Environmental Protection Agency are all involved in the process. As with other policy areas, the division of competencies can potentially lead to problems in implementing a cohesive bioenergy policy, which encompasses all different sectors and aspects of bioenergy.

General Concerns Regarding Bioenergy

Aside from the unique policy circumstances in Germany and the United States, bioenergy raises several other, more general concerns that both nations will have to address should this become a viable, climate-friendly source of energy. While bioenergy is considered to be a source of energy without emitting greenhouse gases, the production of the crops needed to produce bioenergy is not without environmental problems. Rainforest deforestation caused by farmers enticed by the profits available from bioenergy subsidies could become a large difficulty, offsetting the CO_2 savings of bioenergy by reducing forest areas able to store CO_2. Additionally, should bioenergy production become more large scale, the use of pesticides and fertilizers could become a further environmental concern. Also concerning is the competition for arable land and the impact on global food prices, which have been rising in recent years. Furthermore, not every crop has proven to yield an adequate energy production ratio, making a differentiation between crops in producing bioenergy absolutely necessary. Compounding this is the fact that biomass has, in contrast to fossil fuels, a diffuse, low spatial density. That means that more land has to be used in order to produce the same amount of energy, leading to competition for land and resources with agriculture and the timber industry. Land conservation movements add additional pressure.

It is, therefore, not enough to implement policies that encourage the production and use of bioenergy. Rather, Germany and the U.S. should lead the world in implementing smart policies. This includes the recognition of the limits of biomass availability and the allocation of biomass to the most efficient pathways (i.e., in the supply of heating rather than in the transportation sector). Existing policy tools must be used to enhance sustainability, while the integrity of ecosystems and multifunctional landscapes needs to be maintained. A successful climate and energy policy will therefore have to rely on bioenergy as only one tool and also include improving energy efficiency and energy saving efforts.

The Short-Term Potential of Climate-Friendly Technologies

In the debates about global warming and climate change, technical fixes are usually regarded as one of the most important solutions. Many technical solutions, however, will require years of development, testing, and implementation—time that might not be available if mitigating the existing effects of climate change requires immediate action. True technical breakthroughs are random and rare and can encounter entrenched interests that lobby to stymie them, requiring additional time to truly disseminate any advances. This leads to questions of what kind of technological fixes are feasible in the short term, what can they achieve, and what kind of policies are required to trigger their continued development and implementation? Additionally, different agendas are competing for the same amount of financial and policy resources, which further impedes policies that support climate-friendly technologies. Advocates for environmental protection, concerns about security and safety, and financial implications and realities can conflict with

each other on the national and global levels. To develop sensible policies that in turn trigger climate-friendly technologies that take security and the financial bottom-line into account—making them multi-benefits opportunities—is therefore imperative.

The Building Sector

Just as each country faces its own unique challenges connected to global warming, each industry sector is also confronting distinctive problems and has to find complementary solutions. The building sector presents one of the biggest challenges for policies addressing climate change; in Germany alone, this sector accounts for one-third of greenhouse gas emissions.

GERMANY

The situation in the German building sector is further complicated by the fact that the building stock tends to be long-lasting and with few renovations. Thus the buildings that are in place, combined with those being erected now, determine the energy demand of this sector in the future, which means that "emission reductions from the building sector can only be achieved with policies and measures which are designed to address long-term processes."[8] Yet, this can also be an advantage in comparison to the U.S., as a building's longer lifetime means that measures to save energy become more profitable. The building sector also offers a large amount of potential. Implementing "[i]nsulation and new heating equipment for existing buildings can reduce the specific energy consumption up to 85 percent,"[9] for example. New buildings can now be designed to have extremely low or almost zero energy consumption. A good example of this is the Technical University Darmstadt's winning entry at the Solar Decathlon Competition 2007 in Washington, D.C. Instead of consuming energy, their house actually produced additional energy through solar panels and energy efficiency measures, tapping into Germany's feed-in law requiring electricity providers to buy renewable energy at above-market rates. Germany has also implemented a variety of measures to increase energy efficiency in the building sector, with the most successful measure being the CO_2 Building Renovation Program by the German KfW Bankengruppe, a public law institution owned by the federal government and the German *Länder*. This program alone contributes to savings of 5.3 million tons of CO_2 annually. Additional measures including incentive programs for biomass translate into further savings of 18.6 million tons of CO_2 annually in the building sector alone.[10]

UNITED STATES

A recent report by the American Council for an Energy-Efficient Economy stated that the state of Virginia, for example, "can meet close to 20 percent of its electricity needs by 2025 through energy efficiency, a strategy that would also cut Virginians' utilities bills by $15 billion by 2025 and create nearly 10,000 new jobs."[11] These savings can be accomplished by very feasible behavioral changes and technical modifications, such as lighting control measures, more efficient heating and air conditioning systems, and more efficient electrical motors and pumps in industrial facilities. An additional very feasible technological fix that can be established in the near term are programmable thermostats. As "[t]he average U.S. household spends about $1,000 a year on heating and cooling [, a] programmable thermostat can reduce that cost by 25 percent to 30 percent. If programmable thermostats could be deployed universally in the United States within a three to eight year time frame the total energy savings could be […] around 5 percent of all U.S. energy consumption."[12] Disseminating programmable thermostats to every household in the U.S. seems like a very easily implementable technological advancement, yet when taking into account that, for example, approximately a quarter of U.S. houses already have a programmable thermostat, but only about half of them use these regularly, it becomes clear that technological fixes can only be useful if they are paired with behavioral modifications. Thus technological advances triggered by good policies have to be complemented by education, marketing, and cultural changes.

The Transportation Sector

The transportation sector consists of a variety of different fields, combining ground and railway transportation with national and international air transport.

GERMANY

In Germany, most policy measures aimed at regulating greenhouse gas emissions from the transportation sector have been voluntary, such as agreements with the car manufacturing industry to increase cars' efficiency. Other policies have tried to create incentives for behavioral changes, such as the implementation of tolls for long-distance trucks designed to shift freight transport to the railways The voluntary nature of measures such as this has not had the desired effect in greenhouse gas emissions. However, "[i]f the existing voluntary agreement is transformed into mandatory standards and the standards are set at 130 grams CO_2 per km in 2012 and 100 grams CO_2 per km in 2030 this would lead to an emission reduction of additional 16 million ton CO_2 in 2030."[13] The European Union agreed in December 2008 to implement a policy to require European automakers to reduce CO_2 emissions from new cars to 130 grams per kilometer. While this is an important next step, environmental groups have criticized the EU for allowing car makers to reach the target only by 2015, instead of by 2012 as originally intended. The sliding scale means that only 65 percent of the target will be met by 2012.

UNITED STATES

The United States transportation system relies heavily on the use of the automobile and is thus especially dependent on fossil fuels. High gas prices were one of the focal points of the most recent presidential election, underscoring this dependency. As with the building sector, behavioral changes might be more influential than technological fixes, at least in the short term. In its energy saving tips, the U.S. Department of Energy suggests curbing aggressive driving, keeping tires probably inflated, and considering buying a highly fuel-efficient vehicle, among others.[14] While behavioral changes cannot be discounted and do have a large impact, espe-

cially on energy efficiency, these suggestions have highlighted two additional facts of the current debate in the United States: First, behavioral modification does not change the fact that underlying policies stimulating technological advances are missing and will need to be implemented in the long run. Second, the suggestion of properly inflated tires was mentioned in the debates leading up to the U.S. presidential elections in the fall of 2008 and was not very well received, underscoring the fact that technological fixes are expected and sought after in the U.S.

In reforming their energy systems, Germany and the United States will encounter several infrastructure problems that will have to be solved. The decentralization of production, the establishment of smart grids, and increased storage capacities will all play a large role. Additionally, the geography of power supply will be significantly altered, as a future relocation of production is not always congruent with the main locations for energy consumption. In Germany, for example, energy production will be concentrated more toward the coastline (i.e., wind energy), whereas demand for energy is focused on southern and central Germany. Policies addressing climate change will also have to take these infrastructure questions into account.

Conclusion/Policy Recommendations

Limiting climate change and mitigating the existing effects of global warming are among the most existential challenges of our times. The new U.S. administration under President Barack Obama has given hope to the world that the U.S. will finally become a driving force on the international arena for new climate policy. Europe has taken the lead in implementing the first ever cap-and-trade emissions system, and lessons from this experience and other policies in Europe and Germany underline several factors that should be the basis for any useful policy:

- Mandatory targets are necessary to provide not only compliance and actual emissions reduction, but also a reliable and continued framework for innovation and technological growth.

- Targeting solely one sector (i.e., the transportation sector) or one possible source of renewable energy (i.e., bioenergy) leads to market disruptions and unnecessary costs. Additionally, it shifts research and innovation efforts away from potentially more promising sectors and energy sources.

- Each policy will have to be assessed periodically for unintended, potentially negative side effects and the impact it has on both the reduction of emissions and markets.

- Policies designed to introduce climate-friendly technology into the market and ensure its dissemination are necessary, especially since these technologies are often initially more costly than their non-climate competitors. However, these policies should not be technology-specific but directed toward their intended ecological effect (i.e., reduction in CO_2 emissions). They will have to be carefully monitored so that they do not overly distort markets and are not implemented longer than necessary.

Furthermore, the evaluation of policies aimed at energy conservation and reduction of emissions in other countries can prevent considerable policy missteps. A successful policy spurring energy efficiency for consumer goods has been the Japanese "Top Runner Approach," which requires competitors to meet the same energy efficiency standards as the most energy-efficient technology on the market. If that is not met in a certain time frame, the product is no longer allowed to be sold. The policy thus aims at creating an incentive for earning money with energy efficiency.

However, technological fixes, which are often regarded as the ultimate solution in combating climate change, cannot become the only way out. The lead-time for technology can amount to several years and breakthroughs are random. The question of dissemination and required behavioral changes are additional obstacles. The fundamental question that policymakers on both sides of the Atlantic therefore have to address is: How can climate policies be designed so that they not only stimulate research and development needed to come up with climate-friendly technologies but also ensure that these technological breakthroughs are disseminated and actually used?

Europe and Germany have relied on pricing incentives that can spur behavioral changes and have been somewhat successful with it. The carbon footprint of Germans is significantly lower than that of Americans. The high gas prices in the summer of 2008 and U.S. consumers' reactions have been an indication that Americans also react to price changes with simple behavioral changes or by substituting gas through more energy-efficient technologies. These demand changes will also have an impact on what companies produce.

Policies targeting the demand side will have to be complemented by policies designed to improve the supply side of climate-friendly technology. These policies should be especially targeted at encouraging research collaborations, like the one between the Massachusetts Institute of Technology (MIT) in the United States and the Fraunhofer Gesellschaft in Germany. The newly founded MIT-Fraunhofer Center for Sustainable Energy Systems (CSE) "is dedicated to serving the research needs of the sustainable energy industry by helping established industry players and newcomers alike move clean energy technologies from the laboratory to the production line."[15] Such collaborations are vital to achieving success and policies supporting these collaborations should be implemented further in the United States and in Germany.

Combating climate change is crucial for our societies. Eight years of political stalemate between the United States and Europe on this issue have led to international inaction, yet many policies have been implemented on the European and U.S. state level. Under a new U.S. administration and together with Europe and the rest of the world, these policies have to be evaluated, leading to sensible international policies. It is time for the U.S. to rejoin the international

community and for Europe to refrain from resting on the emissions trading system. It is time for coming up with the most sensible policy option that achieves the climate goals necessary for a planet in peril. This Issue Brief aims to add a small part in accomplishing that.

NOTES

1 See EU Commission, "Limiting Global Climate Change to 2 Degrees Celsius," (2007), <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:52007DC0002:EN:NOT<

2 See Joseph E. Aldy, *AICGS Policy Report* 35 (2008): 7.

3 Ibid., 14.

4 In the U.S. the per capita use of energy in 2003 equals 7.8 tons of crude oil while in Germany it is only 3.9 tons in 2005. See <http://www.eds-destatis.de/de/tdm/downloads/2007_06/pm_12620060921.pdf>.

5 Tobias Plieninger, *AICGS Policy Report* 36 (2008): 29.

6 U.S. Department of Energy, <http://www.energy.gov/energysources/bioenergy.htm> (3 December 2008).

7 U.S. Department of Agriculture, <http://www.ers.usda.gov/Briefing/Bioenergy/> (3 December 2008).

8 Felix Chr. Matthes, *AICGS Policy Report* 37 (2008): 46.

9 Ibid., 46.

10 Ibid., 37.

11 Lewis J. Perelman, *AICGS Policy Report* 37 (2008): 10.

12 Ibid., 12.

13 Felix Chr. Matthes, *AICGS Policy Report* 37 (2008): 49-50.

14 Lewis J. Perelman, *AICGS Policy Report* 37 (2008): 13.

15 MIT-Fraunhofer Center for Sustainable Energy Systems, <http://www.fraunhofer-cse.org/about.htm> (5 December 2008).

The challenge of securing our energy supply in a climate-friendly way is one of the biggest global problems of our times. German and European policymakers hope that next U.S. administration will elevate this issue to the top of the transatlantic agenda, a prerequisite for an international solution. With the generous support of the *Daimler-Fonds im Stifterverband für die Deutsche Wissenschaft*, AICGS completed a project to address this challenge in the German-American context and provide a range of viable transatlantic solutions.

Tim Stuchtey is the Director of AICGS' Business and Economics Program and Director of the Humboldt Institution for Transatlantic Issues. He can be reached at tstuchtey@aicgs.org. **Kirsten Verclas** is the Research Program Associate at AICGS and can be reached at kverclas@aicgs.org.

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1755 Massachusetts Ave., NW
Suite 700
Washington, D.C. 20036 – USA
T:+(1-202) 332-9312
F: (+1-202) 265-9531
E: info@aicgs.org
www.aicgs.org

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