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AICGSPOLICYREPORT

CLIMATE CHANGE AND ENERGY SECURITY: LESSONS LEARNED

Joseph E. Aldy
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AMERICAN INSTITUTE FOR CONTEMPORARY GERMAN STUDIES THE JOHNS HOPKINS UNIVERSITY

AICGS AMERICAN INSTITUTE FOR CONTEMPORARY GERMAN STUDIES

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FOREWORD

This is the first Policy Report in a series of AICGS policy reports on climate and energy policies following the AICGS Policy Report Overcoming the Lethargy: Climate Change, Energy Security, and the Case for a Third Industrial Revolution. Our gratitude goes to the Daimler-Fonds im Stifterverband für die Deutsche Wissenschaft which supported the production of these reports as well as the accompanying workshops and policy dialogues.

Climate Change and Energy Security: Lessons Learned delivers some extremely valuable insights into the respective debates on both sides of the Atlantic. Joe Aldy, Camilla Bausch, and Michael Mehling shed light on the experiences Germany and the United States have had in these important issue areas over the course of the last few decades. They examine the extensive climate and energy track records in both countries including the action at the federal and sub-federal levels, voluntary and mandatory measures, and the use of diverse instruments such as emissions trading, energy efficiency programs, support for research and development, and fuel diversification programs. Their essays examine measures that have been highly contested at home as well as policies which have an impact on shaping the international agenda.

Past experiences can inform other levels of political organization in the domestic realm but also guide decision-makers elsewhere. After all, there is no need to duplicate the mistakes made elsewhere but great merit in copying the successes others have had. By sharing experiences, new ideas are generated, learning curves are less steep, and future confidence increases. This is particularly true for two countries like the United States and Germany which share many similarities, among them comparable industrial structures.

German and American experiences with different climate and energy activities are mixed but together they show that something can be done. The evaluation of the lessons learned will help design more efficient programs in the future. We will have to widely implement the best practices at hand to succeed in what might be this century's most important challenge: protecting the environment while growing our economies and securing the supply of energy.

AICGS is grateful to the Daimler-Fonds im Stifterverband für die Deutsche Wissenschaft for its generous support of this project and to the authors who have committed their time and energy. The Institute would also like to thank Jessica Riester for her work on this publication.

Dr. Jackson Janes
Executive Director
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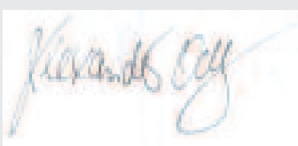

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CLIMATE AND ENERGY POLICY: LESSONS LEARNED FROM THE UNITED STATES

JOSEPH E. ALDY[1]

Section 1: Introduction

Growing concern about the risks posed by climate change and the record run-up in oil prices in 2008 have brought climate and energy issues to the forefront of the policy debate in the United States. Recognition of the potential synergies in addressing climate change and energy security concerns continues to emerge in the energy, environmental, business, security, and political spheres. A successful long-term effort in addressing climate change will necessitate a transformation of the energy foundation of industrial economies. Many of the opportunities for reducing vulnerability to energy price shocks and price volatility will deliver climate dividends. A thoughtful response to the dual climate-energy challenge should take an integrated policy approach.

To assess how to move forward on climate and energy issues, it is first prudent to look back and learn from our experiences. A substantial policy track record on climate and energy issues is available at the state and national levels in the United States. Some of these policy efforts achieved success; others have been failures. Lessons can be learned from both mistakes and achievements, potentially informing the future design of climate change and related energy policies. These lessons can also benefit policymakers around the world as they assess their opportunities for moving forward with the development of a low-carbon energy infrastructure.

To provide context for the policy experiences at the state and national level in the United States, first consider some of the characteristics of the U.S. energy system. U.S. carbon dioxide emissions from the combustion of fossil fuel has increased 19 percent since 1990 (Figure 1). Most of the emission growth occurred during the 1990s: carbon dioxide emissions in 2007 were only 2.6 percent greater than they were in 2000. This slower emission growth is expected to continue as a result of new policies established in recent federal energy bills and state-level initiatives (see Sections 3 and 4 below), higher energy prices, and slower near-term economic growth. The U.S. Energy Information Administration forecasts that U.S. carbon dioxide emissions will increase 7 percent between 2007 and 2020 under current laws and policies.[2]

The historic growth in emissions has occurred at a much slower rate than growth in income. Figure 2 illustrates consistent decarbonization of the U.S. economy since the early 1970s. Over thirty years, the amount of carbon dioxide emitted per unit of output has fallen by half. As evident in the discussion of state-level experiences in Section 2, most of this reflects improvements in energy efficiency and a shift in the composition of economic activity away from energy-intensive manufacturing to energy-lean services and high-tech sectors. Figure 3 shows slow growth in energy consumption, reflecting the improvement in energy efficiency, but little change over time in the various fuels' shares of total energy consumption, reflecting little decarbonization of energy. Fossil fuels continue to make up a large share of the U.S. energy system.

While it is obscured by the scale in Figure 3, some renewable power has increased significantly over the past decade. Specifically, wind power generation has increased more than ten-fold over the past decade, although growth in other renewable sources of power has lagged behind (Figure 4). This growth in wind reflects efforts at the state level to create demand for renewable power generation through renewable portfolio standards (Section 2) and federal efforts to stimulate supply through production tax credits (Section 3).

The policies that have shaped the current energy system will significantly influence and inform the design of future policies to address greenhouse gas emissions (Section 5). These efforts have driven the development and deployment of various energy technologies that will affect the costs of a climate change policy program, and have illustrated the relative effectiveness of various approaches to energy policy. These experiences can help frame the important policy design issues that will merit consideration in the design of future climate and energy policies.

The next section of the essay reviews the experiences and lessons learned from efforts undertaken by the states. The states have long been considered "policy laboratories," and many have undertaken independent efforts to mitigate greenhouse gas emissions, promote renewable energy, and facilitate energy efficiency investments. The third section re-orients attention on efforts pursued at the federal level to address various elements of national energy policy. This section presents lessons learned from energy efficiency programs, fuel diversification strategies, and support for research and development. The fourth section examines the impacts of voluntary goals and voluntary policies on U.S. greenhouse gas emissions. The fifth section takes a prospective look at U.S. climate policy through an examination of the policy proposals for mandatory domestic emission mitigation policies considered in the 110th Congress. This section also provides a detailed assessment of the key policy design issues that will continue to frame the debate over domestic climate change policy. The final section concludes with closing comments on the value of learning from our climate and energy policy experiences.

Section 2: The States as Laboratories of Climate Policy

THE STATES' CARBON DIOXIDE OUTCOMES

An overview of the evolution of the states' carbon dioxide emissions can provide valuable context for the survey of their energy and climate policies. State-level per capita carbon dioxide emissions vary by a factor of ten.[3] The states can serve as a laboratory for understanding how per capita emissions may evolve as economies develop and their populations achieve greater levels of per capita income. As an initial simple characterization of the drivers of U.S. CO_2 emissions at the state level, Aldy employs the Kaya Identity to decompose emissions into the effects of population, per capita income, the energy intensity of output, and the carbon intensity of energy.[4] This identity can illustrate whether improvements in energy efficiency, decarbonization of energy, or simply changes in economic growth or population growth are causing changes in CO_2 emissions. The Kaya Identity for CO_2 emissions is given by:

$$CO_2 = Population \bullet \left(\frac{Income}{Population}\right) \bullet \left(\frac{Energy}{Income}\right) \bullet \left(\frac{CO_2}{Energy}\right)$$

Table 1 illustrates the trends in emissions with average growth rates derived from the Kaya Identity decomposition. In Panel A, the average CO_2 growth rate for all states of 2.0 percent is roughly on par with the growth in income per capita of 2.1 percent, while population growth of 1.1 percent was offset by the decline in the energy intensity of output of 1.2 percent annually. Decarbonization of energy played a negligible role. Some of the decline in energy intensity of output reflects a transition from more energy-intensive economic activity (e.g., manufacturing) to less energy-intensive activity (e.g., services). The state average growth rates presented in Table 1 are not weighted by states' populations, so they will differ from national averages. For example, national-level CO_2 emissions grew 1.7 percent annually and national energy use grew 1.9 percent annually over this period.

The heterogeneity in energy and carbon experiences across the states is evident in the outcomes for a sample of the ten states with the lowest CO_2 growth rates (denoted slow growth) and a sample of the ten states with the highest emissions growth rates (denoted fast growth) over the period of 1960–1999. The fast growth states had a CO_2 growth rate (3.2 percent) four times the rate of the slow growth states (0.75 percent). This substantial difference primarily reflects the faster population growth rates (0.54 percent versus 1.8 percent) and the diverging carbonization trends: slow growth states decarbonized at -0.43 percent annually while fast growth states became more carbon-intensive at a 0.35 percent annual rate. Slow growth states also experienced more rapid declines in energy intensity, but both sets of states had virtually identical income growth rates.

Carbon dioxide emissions grew at highly variable rates over the sample period. Panel B shows the Kaya Identity annual growth rates for the pre-oil shock period (1960–1973), the period of high oil prices

(1973–1986), and the post-oil shock period (1986–1999). The emission growth rates before 1974 were faster than the negligible growth during the oil shock period or the modest growth in the post-oil shock period. The lower CO_2 growth rates during the second period reflected a substantial decline in economic growth (income per capita grew 2.4 percentage points slower) and a steep decline in the energy intensity of output. The oil shocks clearly sent signals to reduce energy consumption and reallocate capital to less energy-intensive sectors, and the productivity slowdown starting in 1973 translated into slower income growth. The emissions growth rate of 1.7 percent in the 1986-1999 period reflects primarily the faster rate of income growth and slower rates of decline in energy efficiency. Decarbonization of energy does not appear to be a major factor in any period.

A more systematic analysis of the relationship between incomes and emissions through a so-called environmental Kuznets curve estimation framework illustrates the importance in accounting for trade in understanding how emissions evolve with economic growth. Figure 5 shows the emissions-income relationship for two measures of emissions. The “production” measure of carbon dioxide is the standard measure of emissions that attributes emissions to the state where they occur (the same approach taken for reporting under the UN Framework Convention on Climate Change). The “consumption” measure reflects a modification for interstate electricity trade that attributes the emissions with power generation to the state of consumption. For example, the power Nevada exports to California would attribute the emissions to Nevada in the production measure and to California in the consumption measure. The production measure of emissions per capita follows a typical inverted-U shape for the production measure of carbon dioxide, but a starkly different pattern after controlling for trade is evident for consumption emissions per capita. In this latter case, emissions appear to peak and effectively plateau. These dynamics may be important when considering long-term emission forecasts.[5] Obviously, not every state can evolve to become a net importer of emission-intensive electricity, just as in the international context not every country can become a net importer of emission-intensive goods. This analysis suggests a serious consideration for consumption measures in understanding how incomes drive carbon dioxide in the bundle of goods and services consumed.

The variation in the states can also provide an understanding of dynamics underlying the geographic distribution of pollution, which can inform policymakers of the need for and the impacts of environmental policies. The distribution of per capita CO_2 emissions may have important implications for the design of climate change policy even though the climatic impact of CO_2 emissions do not vary by the location of emissions sources. In the international policy context, governments as well as non-governmental organizations have advocated for per capita allocations of emission rights. For example, Bodansky identified ten proposals for the design of a successor to the Kyoto Protocol that would distribute emission rights to countries on a per capita basis.[6] Allocating allowances on a per capita basis has also drawn attention in the domestic context. Several respondents to the U.S. Senate Committee on Energy and Natural Resources solicitation of views advanced per capita allocation under a domestic greenhouse gas cap-and-trade program.[7]

A hypothetical U.S. policy can illustrate the potential impacts of using a per capita emissions allocation in lieu of a historical proportional allocation. Suppose that the United States implemented its Kyoto Protocol commitment of 1990 minus 7 percent and decided to allocate emission allowances to the states either through a per capita allocation (based on each state's share of 1999 U.S. population) or a historical proportional allocation (based on each state's share of 1999 U.S. CO_2 emissions). These two schemes would yield dramatically different allocations: the average state would receive an allocation under the per capita scheme that differs by 40 percent from the grandfathering allocation. Since emission allowance prices could range from tens to hundreds of dollars per ton of carbon dioxide, tens of billions of dollars in annual rents would be at stake with the allocation.

If per capita emissions converge over time (say, as income per capita converges), then the difference between a per capita allocation and a historical proportional allocation would decrease. This would reduce the magnitude of rents at stake and limit the potential for political dispute over the allocation of emission allowances. In contrast, if per capita emissions diverge over time, this could complicate efforts to achieve an agreement on climate change policies, in both national and international contexts. Those with low per capita emissions may not be inclined to take on emission commitments that are a function of historic emissions while those with high per capita emissions may not be inclined to agree to any policies premised on per capita emission allocations. The U.S. states can effectively serve as a laboratory of economies at advanced stages of development. If they do not experience emissions convergence even as their incomes converge, then that may raise questions about what should be expected for national-level emissions distributions in the future even if incomes do experience some convergence among developed and developing countries.

An earlier report finds a striking divergence in state-level production CO_2 per capita over the 1960–1999 period.[8] There is weak evidence of divergence in state-level consumption emissions per capita (that is, for emissions after accounting for interstate electricity trade). These trends have occurred while state-level incomes converge, continuing a pattern dating to the 1870s. Figure 6 illustrates the divergence in emissions and income convergence by presenting the standard deviation in emissions per capita over the 1960-1999 period. The report also presents forecasts of the emission distributions, and finds that future distributions would likely reflect continuing divergence.[9]

SETTING STATE CLIMATE POLICY GOALS

This survey of the carbon dynamics in the states provides the foundation for considering the climate policy goals set by a number of states. At least seventeen states have established state-wide emission targets (Table 2).[10] These include near-term targets almost on par with the Kyoto Protocol, such as the State of New York's 1990 -5 percent target for 2010. Many of the New England states aim for 10 percent below 1990 levels by 2020, and other states with expressed goals tend to cluster around 1990 levels by 2020. A number of states have established long-term goals. California and Florida aspire to lower emissions to 80 percent below 1990 levels by 2050, while New Mexico and Oregon aim for 75 percent below 2000 levels by 2050, and still others, like Massachusetts and Vermont, have established long-term emission stabilization goals of 75-85 percent below 1990 and 2001 levels, respectively. Recently, Virginia established a goal to lower its emissions to 30 percent below forecast business-as-usual levels by 2025. It may not be surprising that many of the states with the most ambitious near-term emission targets are net importers of electricity, and have production emissions lower than consumption emissions as described in the previous sub-section.

Many of these states are integrating their efforts through regional programs. This reflects the critical need to move beyond setting goals and actually develop policies to implement and achieve these goals. The northeast and mid-Atlantic states of Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island, and Vermont have launched the Regional Greenhouse Gas Initiative (RGGI).[11] The Memorandum of Understanding governing RGGI establishes emission caps on the utility sector roughly equal to current emissions over the 2009-2014 period. After these six years of emission stabilization, the caps decline at a 2.5 percent annual rate through 2018. By 2018, utility sector emissions should be 10 percent below the allowed emissions in 2009, the first year of the program.

The Western Climate Initiative brings together Arizona, California, Montana, New Mexico, Oregon, Utah, and Washington, with the Canadian provinces of British Columbia, Manitoba, Ontario, and Quebec to lower their total emissions to 15 percent below 2005 levels by 2020.[12] Likewise, a group of midwestern states—including Illinois, Iowa, Kansas, Michigan, Minnesota, and Wisconsin—and the province of Manitoba are working together through the Midwestern Regional Greenhouse Gas Accord.[13] Under this accord, the participating states and province will establish greenhouse gas reduction targets and develop a cap-and-trade program covering multiple sectors of their economies to facilitate attainment of the established targets. The midwestern program is expected to move forward with targets and implementation policies by 2010.

The states have pursued a variety of policies to mitigate their greenhouse gas emissions. The following sub-sections present examples of three important policy approaches at the state and regional levels: cap-and-trade programs, renewable portfolio standards, and energy efficiency efforts.

State Cap-and-Trade Programs[14]

The core of the Regional Greenhouse Gas Initiative is a cap-and-trade program covering one sector with the point of regulation set at the emission source. The program covers all fossil fuel power plants with generating capacity of at least 25 megawatts. The participating states negotiated state-level caps that primarily reflected their historic emissions. The state-level emission budgets in aggregate reflect the regional emission budget, or the RGGI cap, a process with some similarities to the National Allocation Plans developed for the first two phases of the EU Emission Trading Scheme (without a powerful central bureaucracy to manage the process). The RGGI caps start at 188 million short tons of CO_2 in 2009, and after six years at this level, decline to 169 million short tons by 2018.

The Regional Greenhouse Gas Initiative allocates emission allowances through an auction. The Memorandum of Understanding governing RGGI stipulates that at least 25 percent of the auction revenues should finance consumer benefits programs. In practice, this does not appear to be binding, as most states have decided to commit nearly 100 percent of the auction revenues to energy programs that benefit their consumers. For example, Massachusetts will use its revenues to finance energy efficiency projects with the aim of lowering electricity consumption and offset the impact of higher energy bills under the cap-and-trade regime. Connecticut, Maine, Rhode Island, and Vermont have statutory requirements that they use 100 percent of their auction revenues for consumer benefits programs.

Several elements of the RGGI program will influence the prices of emission allowances. The auction includes a reserve price that serves as a price floor in the market. The September 2008 auction set a reserve price of $1.86 per ton CO_2. While some had expressed concern in advance of this auction that the market in the first year of RGGI would be over-allocated, the clearing price ($2.77) in this initial auction exceeded the reserve price. To ensure against unexpectedly high allowance prices, the program allows offset projects from uncovered sources to be used to satisfy compliance obligations.[15] Any covered utility may use offsets equal to 3.3 percent of their compliance obligation. If the allowance prices exceed an initial trigger price ($7 per short ton in 2005 dollars), then this limit on offsets would be increased to 5 percent. If allowance prices continue to increase, and exceed $10 per short ton (2005 dollars), then the offset limit would be expanded again to 10 percent of a firm's compliance obligation. Moderating allowance prices is important because of concerns that high prices could induce considerable emission leakage through regional electricity transmission.[16]

The program restricts the kinds of projects that can qualify for offsets. An offset project must occur within a RGGI state, and focus on one of the following activities: landfill methane capture, sulfur hexafluoride reductions, carbon sequestration through afforestation, end-use energy efficiency, and avoided methane emissions associated with agricultural manure management.

California is leading the other major effort to pursue cap-and-trade at the state level. California is working with the Western Climate Initiative to ensure that its state efforts to implement Assembly Bill 32 are well integrated with the larger regional effort. California has published a discussion draft that scopes out possible policy design, with the goal of implementation by 2012.[17] The extent of coverage could be as broad as 85 percent of California's emissions, covering the utility, industrial, transport, and residential sectors. The California Air Resources Board, the agency with regulatory authority, has made it clear that additional measures would apply to those sources covered by a cap-and-trade program (such as an accelerated renewable portfolio standard, see below). Applying multiple policies to mitigate emissions on the same set of sources will have implications on the incentives for technological innovation, mitigation costs, and distribution of costs and benefits of the program. The state envisions an allocation system that initially provides a majority of gratis allowances with a "quick" transition to a majority of auctioned allowances. Offsets would likely be allowed in the California program, but probably with a limit set at 10 percent of each firm's compliance obligation.

Renewable Portfolio Standards

The primary policy tool employed at the state level to spur the deployment of renewable power in the utility sector is the renewable portfolio standard (RPS). In most states, a renewable portfolio standard establishes a minimum amount of power that must be generated from renewable sources by each electricity provider. A utility that exceeds this minimum can often generate tradable renewable energy credits that can be sold to other covered utilities with renewable generation below the minimum. This approach can provide flexibility in attaining the state-wide standard that minimizes the cost of producing a given amount of required renewable power.

By 2008, approximately half of the states in the country had established renewable power goals through renewable portfolio standards. Table 3 presents the states with their standards, although it is important to note that many states have interim levels of renewable generation mandated as well. There is substantial variation in the details of implementation. Some states impose different standards on different classes of generators. For example, Colorado's 20 percent renewable generation by 2020 applies to investor-owned utilities. Electric cooperatives and municipal utilities have to generate only 10 percent of their power from renewable sources by 2020 in Colorado. The states also differ in terms of what classifies as eligible renewable power under their standards. While the most familiar types of renewable power, such as wind, solar, and geothermal, are covered by state RPS programs, other sources of power, such as methane from agricultural facilities, coalbed methane, some forms of hydropower, and waste-to-energy production qualifies in some states. Texas, which has a total generating capacity goal instead of a share of generation standard like most states, awards double renewable credits for non-wind renewable generation. Some also have additional technology-specific mandates. Colorado, Washington, D.C., Delaware, Maryland, and Nevada, among others, have specified minimum generation mandates for solar power.

The California Air Resources Board has recommended accelerating the state RPS to 33 percent renewable share of all power generation to facilitate compliance with its 1990 by 2020 target.[18] Other states are also considering ramping up their renewable targets. Some of this effort will also require substantial investments to improve the electricity grid in order to manage this increase in renewable power and deliver it to consumers.

A number of states have also implemented a safety valve in their renewable portfolio standards to ensure that costs do not go unexpectedly high. In Ohio, utilities can pay an alternative compliance payment of $45 per megawatt-hour in lieu of renewable generation, which adjusts with inflation over time. Massachusetts has also employed an alternative compliance payment in its RPS program. In Illinois, generators cannot incur costs that would increase retail prices by more than 0.5 percent of the price paid in 2007. These efforts can protect against high costs, but do so at the expense reaching in the near term the renewable goal. This trade-off is explored further in the discussion of cost containment in section 5.

Renewable energy credit markets have evolved, and brokers have become active in serving as market makers among utilities. This trade in renewable credits promotes cost-effective implementation of the renewable goal. If the larger objective lies in lowering carbon dioxide emissions, then renewable portfolio standards may be a rather blunt and inefficient instrument. First, it effectively imposes the same economic burden on all non-renewable power. Thus, it treats coal-fired generation and gas-fired generation the same, even though the latter produces half as much carbon dioxide emissions per unit of electricity generated. Second, various mandated preferences for specific types of renewable power can introduce inefficiencies in the program with respect to lowering carbon dioxide emissions. Finally, an RPS coupled with a cap-and-trade program—as in the northeast states and envisioned in California—is not likely to impact total carbon dioxide emissions relative to a cap-and-trade only approach. The cap limits total emissions, and so long as the RPS is not effectively more stringent than the cap-and-trade program, the RPS only affects how the cap is attained, not the level of emissions. This restriction on how utilities satisfy their obligations under a cap, by mandating that some share of abatement effort occurs through renewable generation, could impact the costs and the nature of the innovation incentives in the cap-and-trade program.

Policies Promoting Energy Efficiency

The states have pursued a variety of measures to promote energy efficiency over the last three decades. These activities have occurred primarily in the consumption of energy in the residential and industrial sectors, but several states have turned their attention to personal transportation in recent years.

To promote energy efficiency in the residential sector, utilities have advanced demand-side management programs. The original, primary motivation for demand-side management focused on reducing energy demand, especially during peak periods, to allow utilities to avoid investing in relatively expensive generating capacity for these high use periods. Utility demand-side management programs can include energy audits, rebates for energy efficient appliances, and other activities to enhance energy efficiency. In their review of demand-side management programs in the 1990s, Auffhammer et al. find that these efforts reduced electricity consumption by about 2 percent at an average cost of about 2 cents per kilowatt-hour.[19] Demand-side management recently has become less common, especially in competitive electricity markets, but new approaches to improving energy efficiency have become more prominent.

Some utilities have structured interruptible contracts with some industrial energy users and have even designed ways in which they pay customers to use less energy during periods of peak demand.[20] Like demand-side management, these efforts have been motivated by the challenge of meeting peak demand periods and maintaining the integrity of the electricity grid. Several states have advanced the use of demand response efforts to lower energy consumption, including California, Connecticut, Illinois, Maryland, and Michigan.[21] In recent years, demand resources have been included in forward capacity markets effectively serving as a substitute for peak generating capacity during periods of high demand. For example, the New England Independent System Operator (ISO) allows energy efficiency programs to be bid into its forward capacity market just as if they are power plants offering electricity to the market. The Federal Energy Regulatory Commission estimates that such efforts have lowered electricity consumption up to 4 percent during peak consumption days.[22] Interest in such an approach to meeting peak demand is increasing, as demand response resources approximately doubled between 2006 and 2007 in the New York ISO, New England ISO, and the PJM. In addition, third party aggregators have entered into these markets, and by packaging demand response among many small customers they can spread the fixed costs of responding in real time to calls for more power or demand response in a manner that facilitates broader participation.

The expansion of smart meters can further opportunities for promoting energy efficiency and utility load management. So-called smart meters can relay energy consumption information in real-time to utilities. This technology can also facilitate more rational, real-time pricing of energy, and price measures have also contributed to reductions in energy consumption during peak periods.[23] It effectively enables a variety of demand response measures. For example, large customers (primarily industrial and commercial) in New York State operate under real-time pricing, which avails them the opportunity to participate in demand response programs. Other states and specific utilities are moving forward with the deployment of smart meters, and FERC notes that utilities have already announced plans to install up to 40 million smart meters through 2010.[24]

The push for smart meters reflects an effort to continue reform of the pricing of electricity. The standard model rewards utilities for the amount of power they sell to customers, which clearly undermines the incentive they may have for investing in energy efficiency (with the exception, evident in this discussion, for incentives for "load-shaving" to avoid investment in peaker power plants). Several states have moved forward with efforts to "decouple" utility revenues from electricity sales. For example, Connecticut has decoupled distribution revenues from sales for consideration.[25] This could effectively reward utilities for demonstrated investment in energy efficiency improvements just as they are rewarded for installing new generating capacity.

While much of the state-level activity has focused on utility efforts to promote energy efficiency, recent state efforts have the effect of improving fuel economy in the personal transport sector. The State of California developed a greenhouse gas rule under its low emission vehicle program that would require cars and light trucks to meet standards for carbon dioxide, methane, nitrous oxide, and hydrofluorocarbons. Since no tailpipe control technology is currently feasible for carbon dioxide, this would effectively require improvements in the fuel economy of vehicles. The California rule would result in improvement in the fleet fuel economy by requiring 30 percent lower greenhouse gas emissions by 2016. This would result in effective improvements in fuel economy to at least 36 miles per gallon, faster and more aggressive than the new fuel economy standards that would achieve a national average of 35 miles per gallon by 2020. Some sixteen states have joined California. Under the Clean Air Act, California must obtain a waiver to implement regulations more ambitious than current federal policy, but the U.S. Environmental Protection Agency denied the waiver in late 2007. This state-level effort could provide some pressure for further actions to improve fuel economy by the federal government in the future.

HOW STATE EFFORTS CAN INFORM NATIONAL CLIMATE POLICY

These state and regional efforts provide several important lessons for national climate change policy. First, they reveal serious interest in taking action to combat climate change among many states. The lack of federal action does not represent a consensus view among the American public or their representatives at the state level. Second, the states are signaling what may be credible emission targets for a national program by their setting of and implementation of policies to achieve state-level economy-wide targets. Third, the state-level policies also provide some guidance on how a federal program can be crafted to meet national emission goals. They can illustrate the effectiveness of various approaches in mitigating emissions and the associated costs. Finally, some states may push ahead with executive and legislative action in an effort to spur federal action. These states may prefer to avoid full-scale implementation so long as the federal government advances a rigorous national climate change policy.

Section 3: Lessons Learned from National Energy Policy

U.S. energy policy took center stage in response to the oil shocks of the 1970s. Since then, the federal government has promoted improvements in fuel economy in the transportation sector, advanced ways to diversify fuels in both transport and power sectors, and supported energy research and development (R&D) programs.

PROMOTING ENERGY EFFICIENCY

The United States implemented fuel economy standards in the transport sector to reduce oil consumption starting with the 1975 Energy Policy and Conservation Act. For the last three decades, the Corporate Average Fuel Economy (CAFE) program has established a miles per gallon standard for all cars and light trucks sold by automakers in the United States. This program required each major auto manufacturer to meet, on average, a fuel economy standard for all vehicles of a specific type on an annual basis. This would allow an automaker to sell some super-efficient smaller cars to offset gas-guzzling large sedans. While the government assesses compliance on an annual basis, automakers can effectively bank and borrow over-compliance credits over a three-year window. So an automaker that beats the standard in 2007 may generate fuel economy credits that could be used in 2008 or 2009. Alternatively, an automaker that falls short of the standard in 2007 can remain in compliance if it over-complies in 2008 or 2009. The 2007 Energy Independence and Security Act provides additional flexibility to automakers by allowing them to trade credits between their car and light truck fleets and across manufacturers. Automakers that fail to meet the standard must then pay a penalty, and some producers pay this penalty as a regular part of their American business model (such as luxury vehicles from Italy and Germany). Automakers with more fuel efficient fleets (e.g., Japanese and Korean automakers) have never paid a fine for non-compliance and have typically exceeded the standards with ease.

The U.S. Congress established a goal to double passenger car fuel economy from 1974 levels by 1985, which would require average fuel economy of 27.5 miles per gallon. While the standard varied under a series of regulations in the 1980s, the passenger car standard has been at 27.5 miles per gallon since 1990.[26] Light trucks and sport utility vehicles have operated under a separate lower standard. In the 1980s, two-wheel and four-wheel drive trucks were covered by separate standards that slowly increased until reaching 20.7 and 19.1 miles per gallon in 1991. In the 1990s, this distinction was eliminated, and all light trucks and sport utility vehicles have been covered by the same standard ranging between 20.7 and 22.2 miles per gallon over the 1996-2007 period. The overall fuel economy of new vehicle purchases by individual consumers has been flat or fallen for most years over the past decade because of level standards and a shifting mix (until very recently) to light trucks and sport utility vehicles.

This effort to promote fuel economy standards differs from other developed countries' approaches that have relied more on fuel taxes to stimulate energy efficiency improvements. The federal gasoline tax in the United States is 18.4 cents per gallon, and state gasoline taxes add, on average, about another 30 cents per gallon. Some states have relatively high gasoline taxes—motorists in California pay 67.1 cents per gallon for state and federal gasoline taxes in 2008—while others have very low or even zero state taxes on gasoline (such as Alaska). Diesel fuel taxes run slightly higher with a federal tax of 24.4 cents per gallon and a national average of state and federal diesel fuel taxes of nearly 54 cents per gallon.[27]

While a number of studies have found that fuel taxes may spur energy efficiency and lower carbon dioxide emissions at lower social costs than fuel economy standards,[28] the political consensus continues to focus on fuel economy standards as the primary means for reducing petroleum consumption. The 2007 Energy Independence and Security Act significantly accelerates fuel economy standards, raising them to 35 miles per gallon by 2020. This, coupled with bringing in more ethanol into the transport sector, dramatically reduces forecast carbon dioxide emissions from this sector. The much slower growth in transport emissions is evident in comparing the U.S. Energy Information Administration's 2007 and 2008 forecasts in their Annual Energy Outlooks. The U.S. EIA's 2008 forecast for the transport sector shows that emission levels expected to be reached by 2015 in the 2007 forecast, are now not expected to be attained until 2030 (Figure 7). Given the timing of the 2007 Energy Bill, the U.S. EIA had already produced what is now referred to as the early version of the 2008 Annual Energy Outlook that did not account for this bill. Updating the outlook for the important provisions in the bill lowers 2030 carbon dioxide emissions in the transportation sector some 12 percent from what they would be in the absence of these provisions. (The full impact of the 2007 Energy Bill, with many provisions still to be implemented, could be on the order of 7 percent reductions in U.S. carbon dioxide emissions in 2030 from what they would have been in the absence of the bill.)

FUEL DIVERSIFICATION

In the transportation sector, ethanol has emerged as the primary substitute to petroleum for powering personal use vehicles. The federal government initially subsidized the production of ethanol in the 1978 Energy Tax Act. Over the past thirty years, the effective subsidy for gasoline mixed with ethanol has varied between 40 and 60 cents per gallon. In addition, the federal government has imposed tariffs on the import of ethanol at comparably steep rates as the domestic subsidy. In addition to subsidizing the production of ethanol, the federal government encouraged the use of ethanol through its oxygenate requirement in the 1990 Clean Air Act Amendments, and more recently mandated its use through renewable fuel standards. The 2007 Energy Independence and Security Act requires the blending of ethanol into gasoline ramping up from 9 billion gallons in 2008 to 36 billion gallons in 2022, a large fraction of which must come from currently non-commercial cellulosic and second generation ethanol. This would represent a major increase in the production of ethanol, which amounted to 6.5 billion gallons in 2007.

The debate over ethanol has become quite heated for a variety of agricultural, environmental, international trade, and technological issues. First, some have accused the policies promoting ethanol for displacing agricultural production for food and increasing crop and food prices. Second, the current corn-based ethanol technology requires a lot of energy and it displaces no more than 10 to 20 percent of the carbon dioxide emissions associated with petroleum-based fuels. Third, Brazil, a major producer of sugar-cane ethanol, has been very critical of the U.S. import tariffs on foreign-produced ethanol. Finally, questions continue for the commercial viability of next generation (cellulosic) ethanol production. The renewable fuel standard would require 16 billion gallons of cellulosic ethanol in 2022. All of these issues have raised concerns about how best to move forward with renewable fuels in the U.S. transportation system.

In the electricity sector, the federal government has subsidized the production of power from select renewable sources through production tax credits since 1992. The tax credit is on a per unit of power basis, so it serves as a price subsidy. Electricity generated by a variety of sources, including wind, biomass, geothermal, landfill gas, municipal solid waste, hydropower, and some forms of refined coal receive such production tax credits. Wind, closed-loop biomass, and geothermal receive a \$0.02/kWh tax credit; other technologies receive half that rate. The tax credit has lapsed a number of times, and extensions have varied in their length. In the 2008 federal budget continuing resolution, the wind tax credit was extended for one year, while the solar tax credit has been extended for eight years.

The production tax credit has lapsed three times since its initial enactment with the 1992 Energy Policy Act. Each time that the tax credit has lapsed, additions to wind power generating capacity have fallen dramatically relative to the previous year's investment. For example, the production tax credit lapsed in December 2003 and was not restored until October 2004. Wind power capacity additions in 2003 of 1,687 megawatts and in 2005 of 2,431 megawatts dwarfed the capacity added in 2004 of 389 megawatts. While this may reflect some effort in waiting for the re-enactment of the tax credit, it likely shows how important the tax credit has played in the vast growth in wind power generation (Figure 4).

RESEARCH AND DEVELOPMENT

The incentives for private investment vary along the R&D chain from initial idea to commercial product. Basic science R&D effectively represents the creation of knowledge, and given the public good nature of knowledge and information, firms may under invest in such R&D, especially relative to the commercial stage of development. Accounting for these positive spillovers of knowledge creation, an extensive line of academic research has shown high returns to government support for basic science.[29] Given the weak incentive for private investment in basic science, government investment in such R&D typically does not crowd out private sector R&D. This may not necessarily be the case for commercial and near-commercial technologies. Some have advanced a public policy rationale for support of pilot and demonstration projects because of high risks and high information content in implementing first-of-a-kind projects. In these cases, cost-sharing between the government and the private firms may be reasonable, since these firms can still appropriate many of the rents associated with their innovative activity. An effective federal R&D program would avoid public funding of projects that crowd out private investment, which would lower the return to the government investment.

Federal energy R&D peaked in 1979, and in 2006 the federal budget for energy R&D stood at only 37 percent of the peak funding (Figure 8). This does represent a significant improvement over the past decade, where the 2006 R&D budget for energy exceeded the 1996 budget by 20 percent. While nuclear fission and fusion and fossil fuels were the largest recipients of energy R&D support in the 1970s, more funds have moved into energy efficiency in recent years. For example, energy efficiency R&D peaked in 2001 with more than $650 million worth of funding.

Delivering this support for energy and climate-related R&D can occur through a variety of channels. For example, the federal government has achieved success in supporting competitive, extramural research through the National Science Foundation, the Department of Energy's Office of Science, and work undertaken through the country's system of National Laboratories. The 2007 Energy Bill followed a recommendation of the National Academy of Sciences to establish an agency akin to the Defense Advanced Research Projects Agency that would focus on innovative energy research. This so-called ARPA-E would finance extramural research on cross-cutting, transformational science and technology at universities, private sector start-ups, and other research institutions. The Bush administration, however, has indicated no interest in funding ARPA-E.[30]

The federal government could also spur private sector commercialization of basic research through competitions. This could draw off of the experiences of the super-efficient refrigerator competition in the early 1990s or the X-Prize for space flight in 2004. Such an approach may appeal to governments operating under tight budgets because the government only pays out for proven winners. Or put another way, this model requires payment for outputs, in contrast to the traditional R&D model that requires payment for inputs. Thoughtful competition design can avoid the problem of "government picking winners" by specifying the characteristics of a winning product without dictating the means of designing the product. The incentive to the private sector can often exceed the cash value of the prize, as competitors vie for non-pecuniary benefits such as media attention and prestige.[31]

IMPLICATIONS FOR THE DESIGN OF CLIMATE POLICY

The economic impacts of new climate change policy, such as a cap-and-trade program, will reflect these recent efforts to promote fuel economy and fuel diversification. The implicit stringency of a cap-and-trade program is represented by the difference between emissions in the absence of the policy and the cap under consideration in the climate change policy. The pursuit of these energy policies have lowered the forecast emissions growth, and will lessen the incremental burden of future climate change policies. This explains, in part, the lower allowance prices from the U.S. EIA analysis of the Lieberman-Warner bill in Table 4 and discussed in Section 5.

These energy policies may also increase the array of new technologies available for use in a carbon-constrained world. Accelerating improvements in energy efficiency and diversifying fuels in the transportation and power sectors, as well as pushing on the R&D dimension can provide more opportunities to lower greenhouse gas emissions under new climate change policies. A coherent climate and energy policy agenda should also account for various interactions between these policies. In some sense, many of these more narrowly focused policies reflect the current political inability to advance a more comprehensive strategy for tackling climate change, such as through an economy-wide cap-and-trade program. Moving to the next stage of policy through cap-and-trade will require a serious review of the existing policy program to assess what effectively complements cap-and-trade and what may be redundant or even costly under the new system.

Section 4: Learning from Voluntary National Efforts

The federal government has pursued a largely voluntary effort in addressing climate change since 1992. This has reflected non-binding voluntary goals agreed to in international fora and established unilaterally, as well as voluntary programs for engaging industry in lowering its greenhouse gas emissions.

IMPACTS OF NON-BINDING GOALS

The United States signed the UN Framework Convention on Climate Change at the 1992 Earth Summit in Rio de Janeiro, Brazil and the U.S. Senate voted unanimously in its advice and consent to ratification of the treaty in the fall of 1992. The UNFCCC established a non-binding aim for industrialized nations, including the United States, to return their greenhouse gas emissions to their 1990 levels starting in the year 2000 (Article 4). The United States did not meet this goal; its emissions grew 1.3 percent annually during the 1990s, and total greenhouse gas emissions in 2000 were 13.6 percent greater than they were in 1990.[32] This failure to comply with the UNFCCC non-binding aim reflected rapid economic growth in excess of 3 percent annually during the 1990s, low energy prices, and a modest policy effort focused on voluntary measures.

A year after stating that the United States would not ratify the Kyoto Protocol in 2001, the Bush administration announced its domestic climate change policy.[33] The domestic policy continued and initiated a variety of voluntary efforts, research and development projects, and modest tax credits motivated by a non-binding greenhouse gas intensity goal. The administration called for a reduction in the intensity of economic output: an 18 percent decline in the ratio of greenhouse gas emissions to gross domestic product over the 2002-2012 period. To achieve this goal, the administration proposed tax credits for the production of renewable electricity and hybrid vehicles, research and development support for hydrogen fuel cell technology in the transport sector, and voluntary agreements with various emission-intensive industries, including aluminum and semi-conductor producers.

The 18 percent improvement over ten years would occur during a period in which the U.S. Energy Information Administration had already anticipated a 14 percent improvement in the emission intensity of output in the absence of any new policies.[34] Given this improvement under business as usual, the tax credits, voluntary agreements, and R&D would only need to deliver an incremental improvement in emission intensity of 4 percent over ten years. In fact, in the first five years under this voluntary goal, the emission intensity of economic output has declined slightly more than 10 percent, representing more than half of the effort necessary to meet the goal. The annual rate of improvement in the carbon-to-GDP ratio has averaged 2.2 percent over 2002-2007.[35] This is roughly on par with the experience over 1973-2002 when the carbon-to-GDP ratio improved 2.1 percent annually.

According to the Bush administration, achieving this voluntary goal would result in the reduction of 389 million metric tons of carbon dioxide equivalent ($MMTCO_2$-eq) relative to forecast business-as-usual level in 2012.[36] Interestingly, this represents less abatement over a longer time horizon (ten years versus eight years) than the non-binding aim President George H.W. Bush agreed to in the UN Framework Convention on Climate Change. Based on the 1993 Climate Change Action Plan, complying with the UNFCCC non-binding aim would have required 414 MMTCO2-eq of reductions from the 2000 business-as-usual level.[37]

This intensity goal merits serious consideration because it could serve as an example for emerging economies. For example, closely-related energy intensity goals have received attention by the Government of China (its 11th Five-Year Plan) and by the heads of state attending the 2007 Asia-Pacific Economic Cooperation meeting in Sydney, Australia. A simple ratio of emissions (or energy) to GDP may not serve as an appropriate goal when an economy evolves in an unanticipated manner. Under slower than expected economic growth, complying with the emission intensity goal could impose greater emission reductions and higher costs, and under faster than expected economic growth it could require fewer emission reductions and lower costs. A sensible emission mitigation policy would require a country to undertake more emission abatement as it becomes wealthier.

The Bush administration used the U.S. Energy Information Administration's (EIA) 2001 emission and economic forecasts in formulating its policy. The policy reflects the U.S. EIA reference case with 3 percent annual economic growth through 2020. In addition, the U.S. EIA published forecasts with higher (3.4 percent) and lower (2.4 percent) annual rates of economic growth. Based on these alternative forecasts of economic and emissions growth, Aldy found that faster growth reduced the necessary emission abatement by 40 to 50 percent and slower growth would require about 25 to 33 percent more emission abatement.[38] This reflects the fact that fast economic growth over the past two decades in the United States has typically reflected expansion of industries that are below average in energy consumption and associated CO_2 emissions, such as in the services and high technology sectors. Developing a policy that would require more abatement expenditures when the country has less income than expected than it would if the country had more income than expected does not provide a good example for developing countries.

In contrast, the government of Argentina proposed an emission target indexed to GDP in 1999 that increased less than one-for-one with economic growth.[39] In this case, the emission abatement required to comply with the target increases with economic growth. A well-designed indexed target should yield meaningful emission abatement under both expected and unexpected rates of economic growth, but should also avoid penalizing a country for slower than expected economic expansion.

IMPACTS OF VOLUNTARY EMISSION MITIGATION PROGRAMS

Since 1992, voluntary programs have constituted the core of the federal greenhouse gas emission mitigation effort. The United States implemented some forty-plus programs through the U.S. Department of Energy and U.S. Environmental Protection Agency in the 1990s to mitigate emissions of various greenhouse gases.[40] Voluntary programs, including those targeted to non-climate environmental issues, comprised 1.6 percent of the U.S. EPA's budget in 2006.[41] The most recent national communication submitted to the UN Framework Convention on Climate Change Secretariat identifies even more voluntary programs in the U.S. Department of Energy, U.S. Environmental Protection Agency, U.S. Department of Agriculture, and more state-level programs supported by the federal government.[42]

Morgenstern and Pizer describe the primary reasons for private firms and the government to pursue voluntary programs: "In principle, voluntary programs offer opportunities for business to get hands-on experience with new types of environmental problems without the straitjacket of regulation, and, in the process, to enhance their environmental reputation with government, customers, investors, communities, employees, and other firms.[…] Voluntary programs also provide opportunities for government agencies to gain experience with new problems and new industries."[43]

An additional issue characterizing the debate over voluntary programs in the context of climate change policy focuses on whether firms that participate as "early actors" in such programs merit credit for this early action in the form of additional, free allowances under a future cap-and-trade program. The prospect of using participation and registered emission reductions to gain potentially valuable allowances at no cost could both induce broader participation and provide incentives to lobby for such benefits in the design of the cap-and-trade program.

The federal government has a long list of voluntary programs, but analyses of two of the most prominent efforts—the U.S. EPA's ClimateWise program and the U.S. DOE's 1605(b) program—can serve as useful illustrations of this approach to climate change policy. The U.S. EPA launched the ClimateWise program in 1993 (and it was integrated into the Energy Star program in 2000). This program engaged firms in the industrial sector and provided information and guidance in how they could lower their greenhouse gas emissions through a variety of energy efficiency and renewable energy technologies and process innovations. As many as 600 firms have participated in the ClimateWise program at any point in time.[44] Participation required an emissions pledge from the firm, and involved assistance from the U.S. EPA and a communication component to highlight program achievements.

With the focus of ClimateWise on promoting energy efficiency, Pizer et al. evaluated the impact of participation in the program on energy use.[45] After carefully controlling for selection effects—i.e., for the fact that firms that opt into the program may differ from those that do not in ways that may facilitate their participation—they found that participating firms may reduce their direct fuel consumption but increase their electricity expenditures some 3 to 5 percent. In other words, the initial effort to reduce direct emissions was achieved in part simply by switching to electricity and increasing indirect emissions.

The U.S. Department of Energy, under section 1605(b) of the 1992 Energy Policy Act, operates a voluntary registry for greenhouse gas emission reductions. The so-called 1605(b) program has traditionally attracted participation primarily by electric utilities. Firms identify their emission mitigation projects, use their own methods for estimating reductions, and then submit this information to the Department of Energy. The discretion delegated to firms in deciding how to measure their emission reductions—at the firm or operating entity level, against historical emissions or a hypothetical counterfactual baseline, absolute emission reductions or changes in carbon intensity, etc.—can significantly impact reported emissions. The program has registered a variety of projects, from fuel-switching, to energy efficiency investments, to off-site carbon sequestration projects through afforestation.

The actual impact on greenhouse gas emissions may be less than suggested by the voluntarily registered projects. Lyon and Kim show that participating firms have growing emissions—so that registered projects are not offsetting other causes of emissions growth—and experience no change in the carbon intensity of their output upon participating in the program.[46] They find that firms participate in the program when doing so incurs low costs and when they face substantial external pressure. Lyon and Kim conclude that participation in the 1605(b) program constitutes a form of "greenwashing." Pizer et al. also evaluate the 1605(b) program for industrial firms, and find a modest decline (4-8 percent) in electricity expenditures by participating industrial entities over at least three years from participation.[47]

Non-binding goals and voluntary policies are not sufficient to the challenge of mitigating the risks of climate change. Despite several goals and numerous voluntary initiatives, U.S. greenhouse gas emissions have grown steadily since 1992, with the exception of 2001 and 2006. While the choice of goals is important for framing policy, it may be even more important now to develop and implement a robust policy infrastructure that can meaningfully implement near-term and longer-term goals. The following section explores in detail how the U.S. may move forward in designing such a policy.

Section 5: U.S. Climate Policy Moving Forward

Considerable interest in a national climate change policy has emerged reflecting pressure from the states, proactive forces in industry, and the environmental community. The U.S. Congress has considered a wide array of proposals for a mandatory, domestic emission mitigation program. This effort highlighted some of the key policy design issues that will need to be addressed in the course of developing a meaningful U.S. climate change policy program. This domestic policy will also have important implications for the design of an international climate policy architecture to build on the Kyoto Protocol.

ASSESSMENT OF CONGRESSIONAL POLICY LANDSCAPE, 2007-2008

The 110th U.S. Congress witnessed a substantial increase in activity on the design of domestic climate change policy. The U.S. House of Representatives created the Select Committee for Energy Independence and Global Warming in 2007. In both Houses, more than 235 bills, amendments, and resolutions focused on climate change have been presented in the 110th Congress and committees and subcommittees have hosted more hearings on climate change than in any previous Congress.[48] This new intensity of effort on climate change policy has been complemented by a focus on serious, mandatory domestic greenhouse gas mitigation policy proposals by the two major parties' candidates for President in 2008, Senators John McCain and Barack Obama.

The proposals for greenhouse gas emissions cap-and-trade and carbon taxes in the 110th Congress likely will serve as the foundation for future policy deliberations, especially since the presidential candidates sponsored and co-sponsored several bills in the U.S. Senate.[49] These proposals will provide a sense of the likely stringency and form of U.S. climate change policy. Economy-wide and utility-sector-only cap-and-trade gained substantial interest in this Congress. Figure 9 illustrates the stringency through 2030 of a number of cap-and-trade proposals. Of the nine cap-and-trade bills presented in this figure, seven focus on economy-wide (or near economy-wide) application of emission trading. Five of these economy-wide bills would return U.S. greenhouse gas emissions to their 1990 levels (or slightly below) by 2020. Given the modest impact of voluntary efforts to-date and the growth in U.S. carbon dioxide emissions to some 19 percent above their 1990 level, and continued forecast growth, lowering emissions to their 1990 level by 2020 would require substantial mitigation effort. Based on the U.S. Energy Information Administration forecast available at the time many of these bills were proposed or debated, a 1990 goal in 2020 would require reducing emissions more than 28 percent from what they are forecast to be in the absence of new policies.

A number of the economy-wide bills would establish binding emission caps through the year 2050, providing certainty about long-term environmental ambition. Several bills set a 2050 emission target of 80 percent below 1990 levels, including proposals by Congressman Henry Waxman and Senators Bernie Sanders and Barbara Boxer. Senator Obama, in his presidential campaign, advocated for a 1990 by 2020 cap and a 1990 minus 80 percent cap in 2050. Several bills would set 2050 targets of 1990 minus 60 percent, including the proposal by Senators John Kerry and Olympia Snowe. Senator McCain, in his presidential campaign, also advocated for a 1990 by 2020 cap and a 1990 minus 60 percent cap in 2050.

The Lieberman-Warner bill received the most attention in the U.S. Senate in the 110th Congress. The bill represents the first cap-and-trade proposal to be voted out of subcommittee and the full committee and served as the focus of debate on the floor of the U.S. Senate in June 2008. Like these other proposals, the Lieberman-Warner bill would have set emission caps at approximately 1990 levels by 2020 and lower emissions to about 65 percent below 1990 levels by 2050. It set binding annual emission targets through 2050.

The intense legislative interest in the Lieberman-Warner bill spurred a number of economic analyses of its provisions. Table 4 presents the estimated allowance prices from four economic modeling efforts by CRA International,[50] the U.S. Energy Information Administration,[51] the U.S. Environmental Protection Agency,[52] and the Massachusetts Institute of Technology.[53] The ranges of prices for the U.S. EPA reflects the results of two different economic models, and the ranges of prices for the U.S. EIA and MIT analyses reflect multiple model runs that varied by assumptions about technological availability (due to innovation or political constraints) and program design elements (such as the opportunity to use international offsets). In all analyses, the cap-and-trade program is expected to start in 2012, and yield prices in 2015 ranging between $22 and $59 per ton CO_2. By 2030, allowance prices would increase to $63 to $161 per ton CO_2, and would likely exceed $200 per ton CO_2 by 2050 based on these modeling outputs. To put these cost estimates in perspective, a dollar per ton of CO_2 is just less than one cent per gallon of gasoline. These also provide additional context for the extent of effort—in economic terms—necessary to reduce emissions to their 1990 levels by 2020.

The variation in economic costs within and across models depends in large part on the design of the cap-and-trade program. Even within a model, the costs can vary depending on the extent of coverage, the allowance allocation (and potential revenue recycling) decisions, the opportunities for offsets, and other factors. Many of these policy design issues have been raised by various Senators during and after the June 2008 debate over the Lieberman-Warner bill. For example, on 6 June 2008 ten Democratic Senators drafted a letter to Sen. Harry Reid, the Senate Majority Leader, and Sen. Barbara Boxer, Chair of the Senate Environment and Public Works Committee, that identified issues of concern in the design of domestic climate change policy.[54] They identified the following issues that merit serious consideration: (1) contain costs and prevent harm to the U.S. economy; (2) invest aggressively in new technologies and deployment of existing technologies; (3) treat states equitably; (4) protect America's working families; (5) protect America's manufacturing jobs and strengthen international competitiveness; (6) fully recognize agriculture and forestry's role; (7) clarify federal/state authority; and (8) provide accountability for consumer dollars. The next subsection explores in detail most of these important policy design issues by drawing on the latest scholarship and real-world ideas proposed in various bills in the 110th Congress.

KEY ISSUES IN THE DESIGN OF DOMESTIC CLIMATE POLICY[55]

The ongoing policy debate about domestic greenhouse gas mitigation policy provides a useful frame for identifying the important design issues and drawing an assessment from past policy experiences. The key issues that will require consideration and likely resolution in the development of U.S. climate change policy include: program coverage and scope, revenues and allowance allocation, offsets, cost containment, and competitiveness.

Program Coverage and Scope

More than 80 percent of U.S. greenhouse gas emissions occur as a by-product of fossil fuel combustion. This can influence the scope of coverage and the point of regulation in a domestic mitigation program. Traditional market-based regulation—the U.S. sulfur dioxide (SO_2) cap-and-trade program, the EU Emission Trading Scheme (ETS), and the Regional Greenhouse Gas Initiative (RGGI) in the northeast states—have focused on large point sources such as power plants.[56] The U.S. sulfur dioxide program focuses on smoke-stack emitters in part because of the technological opportunities to pursue mitigation efforts through end-of-pipe treatment.

Unlike most air pollutants, no end-of-pipe control technologies exist to mitigate carbon dioxide emissions. The full combustion of a ton of coal, a barrel of oil, or a cubic foot of natural gas will always yield a fixed amount of carbon dioxide emissions. Simply by tracking production, consumption, and net imports of fossil fuels, we can generate relatively confident estimates of CO_2 emissions. Care should be taken to account for the sequestration of fuels into products (plastics), exportation of fuels before combustion, or the potential for large emissions sources to capture and store CO_2 underground.[57] Regulating CO_2 at or near the point of fossil fuel production has received substantial attention because it would expand coverage of the program to small and dispersed sources such as in the transport and residential sectors.[58] Monitoring fuel consumption would impose modest administrative costs and would have to regulate only about 2,000 to 3,000 facilities in order to control all fossil fuel CO_2 emissions.[59] Many climate change proposals in the Senate have moved recently in this direction, including the Lieberman-Warner bill, the Bingaman-Specter bill, and the Dingell-Boucher draft bill. Likewise, the Larson and Stark bills proposing carbon taxes would cover all fossil fuel carbon dioxide emissions by imposing the tax upstream at the bottlenecks in the energy supply system.

Despite the potential practicality of broad coverage through upstream regulation at or near the point of production, there have been a number of primarily anecdotal concerns.[60] First, some have advanced the concern that producers cannot pass on the cost of allowances or taxes to consumers. In some cases, this reflects existing institutional constraints. For example, natural gas pipelines tariffs may be regulated in ways that make it difficult for pipeline companies to pass on costs. This may also be a problem with downstream regulation in the utility sector. Electric utilities operating in regulated markets may not be allowed to pass on the opportunity costs of freely allocated emission allowances. Second, some have voiced the concern that firms only change their behavior in response to direct regulation, and will not adjust in response to changes in the prices of carbon-intensive inputs such as fossil fuels. Forcing end users to think about their fossil fuel use in terms of pollution consequences may create a so-called "announcement effect," but the magnitude of this effect would seem to be limited. In contrast to this claim, higher input prices induce firms to invest in factor-conserving technology. This is especially the case for responses to higher energy prices as industrial firms invested in energy-conserving technologies during the period of high energy prices during the 1970s and early 1980s. The run-up in oil prices in recent years also illustrates both pass-through and consumer response to price changes. Higher crude oil prices have translated into higher gasoline prices, and consumption has slowed in response. After annual consumption growth of 1.5 percent for all petroleum products over 1995-2005, U.S. oil consumption has declined since.[61]

The interest in upstream regulation that covers all fossil fuel carbon dioxide emissions reflects concerns about the inefficiency of narrow policy coverage and the difficulty in attaining more aggressive targets. First, excluding some sources from regulation reduces the set of low-cost abatement opportunities to be exploited. Edmonds et al. show that the total cost of achieving a given quantitative target increases five-fold when moving from an economy-wide to a utility-sector only mitigation policy.[62] The contrast could be quite stark between legislative proposals for effectively economy-wide caps (e.g., Lieberman-Warner) and proposals for utility-sector-only caps (e.g., Alexander-Lieberman). Pizer et al. consider both the question of coverage and inefficient policies. They examine the consequences of excluding some sectors from a CO_2 cap-and-trade program as well as employing policies that do not result in cost-minimization of abatement, such as fuel economy standards and renewable portfolio standards.[63] They found that limiting the cap-and-trade policy to the power and transport sectors doubled costs. Using inefficient policies, however, raised costs by a factor of ten.[64]

Second, incomplete coverage of the economy's sources may spur emission leakage. The regulation of large sources may drive energy use toward smaller sources, e.g., home heating by natural gas and heating oil, instead of electricity. Unregulated sources may generate power on-site instead of purchasing power from utilities facing carbon dioxide regulation. This would offset some of the emission abatement in the covered sectors as emissions by uncovered sources increases.

Third, the U.S. EPA shows that under one proposal uncovered sources constitute 20-25 percent of reference case emissions, but they make up nearly half of all emissions after imposing regulations on covered sources.[65] While some suggest that the program could eventually broaden its coverage—starting with a few sectors and then covering other sectors over time, this initial piecemeal approach may produce concentrated special interests opposed to such expansion. This could make it increasingly difficult to reduce emissions further if such sources are not included from the start.

Revenues and Allowance Allocation

Setting a price on greenhouse gas emissions through an economy-wide emission tax or cap-and-trade program with a 100 percent auction could generate $100-300+ billion revenues annually.[66] This volume of revenue raises the important policy question of what to do with this revenue. While early cap-and-trade proposals emphasized free allowance allocation (e.g., the 2003 McCain-Lieberman bill), the Congressional debate has evolved away from this. A number of bills would initially grant some free allowances to industry with a concurrent auction that increases in scope over time (Lieberman-Warner, Bingaman-Specter, and Udall-Petri bills). The policy debate has evolved beyond simply auctioning or granting for free allowances to industry. For example, some proposals provide free allocation to a wider range of affected firms (versus only direct emitters), to states, and to quasi-governmental entities that, in turn, auction allowances to support climate-related activities. At the same time, auction revenues are also being earmarked for a wide range of climate-related activities ranging from adaptation, to technology support, to support for populations adversely affected by the regulation.

A cap-and-trade program effectively rations the right to emit greenhouse gas emissions from covered sources in the economy. This rationing, as for any scarce asset, results in a positive price for emission allowances. This price reflects the value for the right to emit a specified unit of greenhouse gases. Summed over the quantity of allowances, this provides an estimate of both the potential revenue to the government as well as the scale of redistribution between those who will end up paying more for fossil energy and those who initially hold the allowances. In their evaluations of three scenarios matched to various bills under consideration in the U.S. Senate, Paltsev et al. estimated that 100 percent auctioning would yield annual revenues of $130 to $370 billion by 2015.[67] The U.S. EIA finds similar results in its analysis of the Lieberman-Warner bill (S. 2191).[68]

If a cap-and-trade program freely allocates all of the emission allowances (or gives away the revenue from an auction), then the government has decided to redistribute hundreds of billions of dollars. The U.S. Congressional Budget Office has decided to score free allocation as both a revenue and an outlay (subsidy) for budget purposes, reflecting the view that the gratis allocation represents a transfer of valuable assets easily convertible to cash in emission trading markets.[69]

Downstream consumers will generally bear the same energy cost increases under a cap with 100 percent auction, a cap with 100 percent free allocation, or a tax set at the expected price of the cap-and-trade approach.[70] In all three cases, the carbon price represents the opportunity cost of emitting another unit of greenhouse gas emissions. Even if a covered firm receives allowances for free, that firm would still consider the price of those allowances that it could receive in the emission trading market in its decision to use fossil fuels, and subsequently in how it prices its products. The opportunity to sell unused allowances that are not necessary for a firm's compliance, not the initial implicit price of zero the firm faced when acquiring the allowances, will drive firm behavior and pricing decisions. Given the relatively inelastic demand for energy, most of the carbon price would be passed on to consumers. Lasky's survey of various energy-economic models shows that consumers bear up to 96 percent of the price increases.[71]

The combination of the allocation decision and the incidence of emission pricing primarily on final consumers drives the distributional consequences of climate change policy. A free allowance allocation to businesses in the energy-supply chain and the transmission of most of the allowance price to final consumers would likely make these businesses better off—as a group—under climate policy than the status quo. The free allocation effectively transfers valuable assets to firms, and these assets are then reflected in shareholder's equity in the firms. This can lead to increasingly regressive household impacts. The free allocation benefits wealthy shareholders of businesses receiving those allocations, but the costs of the climate policy are distributed among all consumers of energy-intensive goods, which magnifies the regressivity of the policy since low-income households spend more on energy as a share of their income.

For a U.S. climate change policy that imposes an economy-wide carbon price of $15 per ton CO_2, Metcalf shows that the lowest income decile has 1.8 percent lower disposable income, while the top two deciles have higher disposable income under 100 percent free allocation.[72] Likewise, Parry finds that the wealthiest quintile of Americans, who own a disproportionate share of capital, enjoy higher disposable income under climate policy, while the poorest 80 percent of the country experience lower disposable income.[73]

To facilitate broader political support among industry for climate change policy, some have recommended free allocation. Goulder estimated that no more than about 15 percent of emission allowances need to be freely allocated to avoid equity losses in the most vulnerable industries.[74] Free allocations above this level would effectively create windfall profits for those industries. Morgenstern et al. show that about a 20 percent perpetual free allocation would keep all manufacturing industries whole.[75] In his proposal for a U.S. economy-wide cap-and-trade program, Stavins estimates that a 50 percent free allocation phased-down and eliminated over twenty-five years is equivalent to a 15 percent gratis allocation into perpetuity in present value terms (assuming a real discount rate of 3 percent).[76]

The opportunity to generate hundreds of billions of dollars of revenue annually could allow government to lower existing taxes on income, labor, and capital. Financing lower distortionary taxes on these goods through an allowance auction can promote greater labor participation and capital accumulation. This effective tax swap—with interest across the political spectrum, as evident in support from former Vice President Al Gore and former Chair of the Council of Economic Advisers Greg Mankiw, who served under President George W. Bush—could substantially lower the costs of climate change policy. Policies with allowance prices (or emission taxes) up to about $15 per ton of CO_2 with optimal reductions in tax rates and revenue neutrality could result in faster economic growth than no climate policy.[77] For more ambitious climate change policies, Goulder shows that a policy reducing greenhouse gas emissions 23 percent coupled with a 100 percent auction and optimal revenue recycling could result in half the costs to the U.S. economy of a program with 100 percent free allocation.[78]

Auctioning allowances can also inform efforts to address the potential regressivity of the domestic climate change policy. Metcalf explores various approaches to returning revenues to the economy and he finds that an "environmental tax credit" applied equally to all workers' payroll tax obligations can offset most of the regressivity of higher costs of energy goods under climate policy.[79] Extending this approach to include a tax credit to social security recipients can transform a sharply regressive policy into a slightly progressive one.

Beyond lowering distortions in the tax code and addressing regressivity in energy price impacts, some have also called for the use of revenues to benefit various interests. This can occur by appropriating auction revenues or allocating allowances to specific entities that can sell them to regulated firms. For example, the Commonwealth of Massachusetts plans to use allowance auction revenues from the Regional Greenhouse Gas Initiative to finance energy efficiency investments and related demand side management programs. Several U.S. Senate bills would set aside revenues to aid low-income households and workers adversely affected by climate change policy transition into new positions. Allowances or revenues could also support additional R&D on climate-friendly technologies, such as carbon capture and storage and more research in climate science and adaptation (as specified in both S. 1766 and S. 2191).

Offsets

Project-based offsets can serve as a means for securing low-cost abatement among sources that are not covered by the cap-and-trade regime. Offsets can circumvent the political and institutional capacity in some sectors and in some countries by focusing on individual mitigation activities. The theory of project-based offsets is simple: projects that reduce emissions (relative to a hypothetical or counterfactual baseline) are granted credits equal to the volume of reductions, and these credits may be sold into a cap-and-trade program. Firms regulated by the cap-and-trade program buy these credits and use them in lieu of emission allowances to cover some of their emissions.

In practice, offset projects are much more complex. The challenge in designing an effective offset program lies in securing real, as opposed to paper, emission reductions. The assessment of real reductions reflects two problems: measuring actual emission levels and identifying an appropriate baseline. Emission measurement may be straightforward for a utility sector project in a developing country, but difficult or imprecise for agriculture and forestry projects in the United States and abroad. Myers provides an assessment of measurement and baseline issues for tropical forest offset activities, an important consideration for domestic policy design considering several bills would explicitly admit tropical forestry offsets for domestic compliance (e.g., the Lieberman-Warner and Bingaman-Specter bills).[80]

Identifying an appropriate baseline presents a trade-off. Expending more resources on estimating baselines and establishing the volume of real reductions provides greater environmental integrity, but also raises transaction costs and risks diminishing the opportunity for offsets to enter the market. High transaction costs can eliminate most of the potential cost-savings of project-based trading, as evident by the U.S. experience under the 1977 Clean Air Act Amendments. Under these revisions to the Clean Air Act, regulated power plants could use emission offsets from other facilities for compliance with air quality rules. Transaction costs of up to 30 percent of the value of trades plus high EPA rejection rates of 40 percent of all proposed trades led to very modest cost savings of perhaps only one percent.[81] The high transaction costs and limited trade activity stimulated interest in designing the much more efficient SO_2 cap-and-trade program under the 1990 Clean Air Act Amendments.

Project-based offsets could result from domestic agriculture and forestry activities or mitigation efforts in developing countries. For example, the Lieberman-Warner bill (S. 3036) would allow domestic offsets to cover up to 15 percent of a firm's allowance obligation, another 10 percent from international offsets derived from international forest carbon sequestration projects, and another 5 percent from all other international activities. The Lieberman-McCain bill (S. 280) has a similar 30 percent cap on domestic and international offsets, while the Bingaman-Specter bill would allow unlimited offsets from uncovered sources of methane and sulfur hexafluoride and limited international offsets (10 percent) and domestic agricultural offsets (5 percent). The bills in the 110th Congress reflect serious political interest in using offsets to provide opportunities for agriculture and forestry activities, here and abroad, to sequester carbon dioxide in soils, trees, and other land-use activities and deliver low-cost abatement into the emission mitigation program.

Cost Containment

An extensive economic literature dating back to Weitzman (1974) has addressed the question of whether a quantity instrument (i.e., cap-and-trade program) or a price instrument (i.e., an emission tax) would be more efficient in reducing pollution.[82] When abatement costs are well known this choice may not matter much, but it could have serious efficiency implications when this is not the case. In fact, this is not likely to be the case with the regulation of greenhouse gases as firms and government agencies have little current information on abatement costs. While there are cap-and-trade (quantity) proposals and carbon tax (price) proposals on Capitol Hill, the debate has evolved in a manner that attempts to marry attractive elements of both instruments in policy design. This is most apparent in the debate over cost containment.

Since climate change impacts are a function of the atmospheric stock of greenhouse gases, accumulated over many decades, the marginal benefits of mitigating emissions—the flow augmenting the stock—are relatively flat.[83] With annual contributions of about 1/100 of the accumulated volume (above pre-industrialization levels), these annual contributions cannot cause a dramatic increase in marginal damages. In contrast, many analyses show relatively steeper marginal costs. Thus, most economic analyses of policy choice under uncertainty favor prices on efficiency grounds.[84] Using parameters from the broader literature, these studies find price policies, like an emission tax, deliver five times the expected net benefits of quantity policies, like a simple cap-and-trade program.

These results motivate the key question in cost containment: How can we design a quantity-based policy like cap-and-trade (which is favored for a variety of political economy reasons) with the appealing cost certainty available in a carbon tax? A variety of cost-containment measures have been proposed to address this question. First, banking and borrowing provides firms with the opportunity to trade emission allowances over time. This would deliver greater near-term price stability like an emission tax. While banking is frequently allowed under traditional cap-and-trade programs (such as the sulfur dioxide trading system), borrowing is not. Recent Senate bills have proposed various forms of borrowing, including quantitative limits, interest rates, and system-wide versus firm-level provisions (e.g., the Lieberman-Warner bill). Given the stock nature of climate change, relaxing the quantity constraint for any one year while maintaining an aggregate, long-term emission budget would not undermine the environmental benefit of the policy while mitigating possible price volatility in allowance prices in the emission trading market. Ellerman and Sue Wing suggested that banking of greenhouse gas emission allowances could change the price versus quantity results.[85] Banking and borrowing inherently depend on individual and firm behavior to moderate price volatility. If individuals do not bank and borrow as the models predict, they will not stabilize prices—unlike an actual price control that does not leave the outcome in individual hands.[86]

Second, the fixed quantity under cap-and-trade could be relaxed by indexing quantitative caps to economic output. Section 4 discussed examples of this approach in Argentina's national commitment proposal in 1999,[87] and the United States' intensity goal in 2002.[88] Indexing targets can improve on traditional fixed quantity caps when the index is highly correlated with emissions and not too "noisy."[89] The form of the index—a simple intensity ratio or a more sophisticated function of output—should perform well both under expected economic growth and shocks to output.[90] Nonetheless, price instruments still tend to dominate indexed caps on conventional expected welfare grounds.

Third, domestic implementation could include elements of both quantity and price instruments. In recent years, interest in hybrid policies has grown. As noted above, approximately half of the U.S. states have utility sector renewable portfolio standards. In some states, utilities may comply with their regulatory obligation by making alternative compliance payments in lieu of holding sufficient renewable energy credits. These alternative compliance payments are expressed in dollars per megawatt-hour that effectively cap the cost of renewable energy credits.[91] Several Congressional proposals, such as the Bingaman-Specter Bill (S. 1766) and the Udall draft proposal in the House would employ trading with a price cap—otherwise known as a safety valve. The safety valve could operate as insurance against unexpectedly high costs by providing regulated firms the opportunity to buy additional allowances at a pre-set price that effectively relaxes the quantity target. The insurance component would reflect the setting of the safety valve price above the expected allowance price in the emission trading market.

The Boxer Amendment to the Lieberman-Warner bill (S. 3036) includes a price-quantity-price-quantity mechanism that sets a minimum price, a cap (if the minimum price is exceeded), a second price at which additional allowances enter the system (technically borrowed from the future), and then a maximum limit on those additional allowances.[92] This approach would effectively establish a price band for allowance prices except in the unanticipated cases of very high realized marginal costs of abatement.

Other proposals have emerged to mitigate the risk of unexpectedly high costs. A "circuit breaker" would stop a ramp-down in annual emission caps over time if the allowance price exceeds a specified trigger.[93] Such a policy sets future allowance supply (the emission caps) based on past allowance prices, and requires the government to define the "allowance price" trigger. The circuit breaker requires the government to define a market condition in one period (the average price) and then take a distinct action in the next period (change the target). In contrast, the Lieberman-Warner bill would establish a "Carbon Market Efficiency Board." This independent board would be responsible for monitoring the allowance market and intervening in an effort to keep allowance prices within a preferred range, when possible. Finally, some consider the use of offsets as a means to contain costs. The Regional Greenhouse Gas Initiative allows a limited number of project-based offsets to be used for compliance, but increases the number of offsets permitted if allowance prices exceed a pre-set trigger level. The uncertainty in allowance prices associated with the Lieberman-Warner bill evident in Table 4 and concerns about unexpectedly high costs will likely drive continued interest in policy mechanisms to contain costs.

Mechanisms to Address Competitiveness Concerns

Energy-intensive manufacturing firms facing significant international competition have raised the concern that a unilateral domestic climate change policy would adversely affect their competitive position. Drawing on the so-called "pollution haven hypothesis," some business and labor leaders have expressed concern that higher energy prices under a cap-and-trade program may induce U.S. facilities to relocate to countries without such policy-related price increases (i.e., developing countries) or to shift production to facilities already operating in these countries. This competitiveness effect—lower industrial employment and production in the United States coupled with higher net imports than would occur with comparable action in all countries—can reflect concentrated costs on those firms participating in a competitive, international market. Understanding the magnitude and the mechanisms driving adverse competitiveness impacts can inform the design of appropriate policy remedies.

The conventional wisdom that higher regulatory costs drive firms to produce in other countries with weaker (or non-existent) regulations has been difficult to prove empirically.[94] A variety of factors may mitigate or dominate the effect of environmental regulatory costs in determining manufacturing location decisions. First, the availability of relevant factors of production can outweigh pollution control costs in siting decisions. Pollution-intensive industries tend to be capital-intensive, so capital abundance in developed countries may outweigh the impacts of environmental regulations.[95] Second, transportation costs may discourage relocation to countries far from the major markets for manufactured goods.[96] Third, firms with a significant share of their investments in large, fixed physical structures also appear to move activity less in response to environmental regulations.[97] Fourth, proximity to firms that produce inputs or purchase outputs—e.g., agglomeration economies—also discourages relocation.[98]

Since the most pollution-intensive industries tend to be relatively immobile by these measures of "footlooseness," the empirical literature typically finds quite limited impacts of environmental regulations on international competitiveness. Ederington et al. show that U.S. environmental regulatory costs only affect the manufacturing sector's trade with developing countries; the comparability of environmental regulations across the OECD negates any competitiveness effects for U.S. firms with respect to firms in the developed world.[99] Levinson and Taylor show that U.S. pollution abatement costs in the 1970s and 1980s increased net imports in the manufacturing sector from Mexico and Canada.[100] The estimated increase in net imports roughly equaled about 10 percent of the total increase in bi-lateral trade for both Mexico and Canada, suggesting that other factors played much more substantial roles in the evolution of trade among the North American trading partners.

An extensive literature on the competitiveness effects of variation in environmental policies across the U.S. states has shown more significant impacts on domestic firm relocation resulting from variation in the stringency of environmental regulations.[101] The larger domestic competitiveness impacts may reflect the fact that labor costs and availability of capital do not vary much across the U.S. states and transportation costs are less important, relative to the international context.

This empirical literature has focused on retrospective analyses of U.S. environmental regulations. Since a domestic CO_2 regulatory regime does not yet exist in the United States, Aldy and Pizer focus on estimating the historical relationship between industry-level energy prices and production and consumption in the U.S. manufacturing sector.[102] The difference in the changes in production and consumption for a specific industry represents the change in net imports, or what is frequently referred to as the competitiveness effect in the policy debate. This work allows the energy price relationships with production, consumption, and net imports to vary with the energy intensity of production for the 400+ manufacturing industries studied.

The estimated relationships are then used to simulate the impact of a $15 per ton CO_2 price on the competitiveness of U.S. manufacturing. Aldy and Pizer find that higher energy prices associated with this carbon price would lead to a production decline of 1.3 percent on average across the manufacturing sector. This energy price increase would also cause a 0.6 percent decline in consumption (defined as production plus net imports). This suggests that an emission mitigation policy would induce a 0.7 percent shift in production overseas. Table 5 presents results for some of the most energy-intensive manufacturing industries in the United States.

These results suggest that a policy response may not be necessary on economic grounds, and if so, it should be targeted to a few industries. The political interest in this issue, nonetheless, suggests the need for policymakers to consider possible competitiveness remedies. Some options under consideration in the U.S. policy debate include coordinating policy efforts with other countries, using allowance allocations and/or exemptions as means to mitigate adverse impacts on industry, and regulations or taxes on imports.

Raising the cost of energy throughout the world via a coordinated climate change policy effort would serve as the most effective way to ensure that implementing a domestic climate change policy does not result in adverse competitiveness effects. This would maintain a level playing field: a firm facing the same price for emitting a ton of greenhouse gas emissions regardless of its location would have no incentive to relocate. Pursuit of a broad, cost-effective climate change policy across countries can remedy the competitiveness drawbacks of a domestic program.

Competitiveness concerns could also be addressed through the allocation of emission allowances. The key question is whether granting free allowances affects the price wedge between U.S. firms covered by the domestic regulation and their foreign competitors operating without regulatory constraint. Allocating free allowances based on output or similar measures (e.g., employment, as considered in several Congressional proposals) would affect the price difference between foreign and domestic production, acting essentially as a production subsidy. This would provide a stronger response to competitiveness pressures than free allocation based on historic criteria (e.g., past emissions). In this latter case, free allocation does not address the effective price wedge, so employment and production would fall, even if it maintains profits for recipient firms.

Exempting some firms from market-based regulation could obviously eliminate the competitiveness effects of climate change policy. In lieu of complete exemption, which would risk increasing the costs of achieving any given emission goal, a less onerous market-based regulation could be pursued. For example, the Lieberman-Warner bill (S. 2191) placed refrigerants under a distinct cap designed to reduce the impact of the broader cap-and-trade regime on these products' prices.

The most aggressive competitiveness policies would impose a border tax on imports from countries without comparable climate change policies.[103] Imposing a border tax on the carbon content of imports requires very detailed information on the production processes used in manufacturing those imports. Proposals under consideration in several bills in the U.S. Senate would limit the border tax adjustment—a permit-holding requirement—to bulk commodities like cement, rolled steel, etc., for which it is presumably easier to assess carbon content (e.g., the Lieberman-Warner and Bingaman-Specter bills). This proposal would enact the permit-holding requirement only after an evaluation of other countries' efforts—deemed to be inadequate in mitigating emissions—several years after the start of the U.S. program. This mechanism raises key questions regarding compliance with World Trade Organization rules.[104] Coordinated multilateral action on trade sanctions for non-participation and non-compliance, akin to the mechanism in the Montreal Protocol, may be a more fruitful way to implement border tax adjustments.

IMPLICATIONS FOR PARTICIPATING IN INTERNATIONAL CLIMATE AGREEMENTS

The design of a domestic cap-and-trade program will have three major implications for the design of the post-Kyoto climate policy architecture. First, with the continued emergence of cap-and-trade programs in the developed world and initial efforts in linking cap-and-trade programs among the EU, Norway, Iceland, and Liechtenstein, the prospect of linking a U.S. program with others will gain attention. Direct linkage of a U.S. cap-and-trade program with the EU Emission Trading Scheme and other emission trading regimes will depend on the tolerance for the propagation of other programs' design elements, especially with respect to cost containment.[105] For example, if the U.S. program has a safety valve, it is unlikely that the EU would link directly with the U.S. market. These markets may still achieve some of the benefits of linkage (price convergence, liquidity, weakened market power) through indirect linkage if they both accept emission offsets from developing countries. In this scenario, the extent of design element propagation could be weaker, depending on the limits on offsets.

Second, the domestic cap-and-trade program could be designed to facilitate efforts to engage developing countries. Accepting offsets from developing country energy sector projects and avoided deforestation in tropical countries could promote developing country activities to mitigate their emissions. Implementing cap-and-trade through an auction may also provide revenues to finance technology transfer efforts, such as clean technology funds currently envisioned to run through the World Bank. These auction revenues may also support adaptation programs for the most vulnerable developing countries. The long-term credibility of U.S. support for these programs could be strengthened if a fraction of auction revenues are earmarked for such purposes in the Congressional bill that establishes the U.S. program.

Finally, a mandatory domestic mitigation program will substantially increase the credibility of the United States in international negotiations on the post-Kyoto climate policy architecture. One of the problems with the Kyoto negotiations is that all the energy focused on quantitative goals without sufficient attention to the means and political feasibility for attaining those goals. A mandatory domestic mitigation program in the works for the United States would signal the seriousness with which the country is addressing climate change and potentially facilitate trust in the discussion of future commitments. In general, it may be preferred for countries to negotiate over goals and policy actions, with specific details already elaborated in domestic legislation to back up what they can achieve through policy effort.

Section 6: Conclusions

The past three decades have witnessed an extensive array of policy approaches at the national and state level to address first energy issues and more recently the greenhouse gas emissions contributing to climate change. This experience can inform the design of future policies to address climate change and promote the transformation to a low- and eventually zero-carbon economy. The variation across states has served as a valuable policy laboratory that can illustrate cost-effective ways to achieve our climate and energy goals.

While some have criticized the United States for “doing nothing” on climate change as represented by the decision to walk away from the Kyoto Protocol, the record shows that a lot of narrowly focused actions have been pursued and they are slowing the growth of greenhouse gas emissions. This experience also shows, however, that poorly coordinated policy efforts across the federal and state spectrum among a patchwork of non-binding aims and legally binding goals is not sufficient in addressing the risks of climate change. A coherent, economy-wide approach led by the federal government will be necessary to effectively deal with climate change and related concerns about energy security.

It is important to recognize that these lessons can benefit the design of U.S. policy, as well as the development of more ambitious policy agendas around the world. Likewise, the United States has and will continue to learn from the policy efforts in Europe and elsewhere. Establishing well-functioning, coherent, effective, and cost-minimizing climate and energy policies will be critically important as emerging economies seek out examples of best policy practice in their efforts to move forward and play more substantial roles in the global effort to confront climate change.

Figure 1: *U.S. Fossil Fuel Combustion CO2, 1990-2030*

Notes: Historic data from U.S. Energy Information Administration's International Energy Annual 2005 and forecast data from U.S. Energy Information Administration's Annual Energy Outlook 2008.[106]

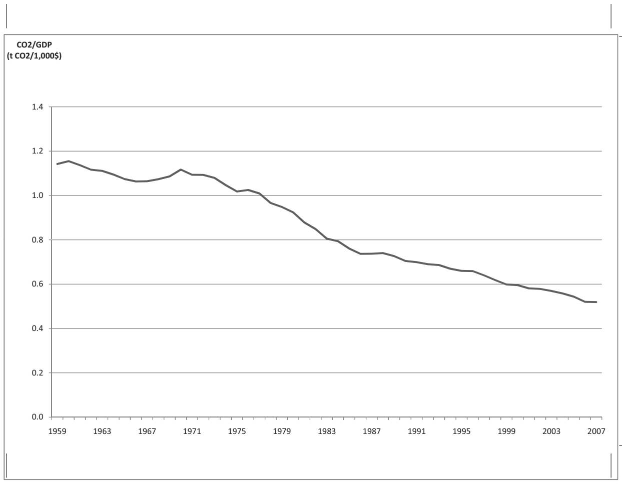


Figure 2: *U.S. Fossil Fuel Combustion CO2 to GDP Ratio, 1959-2007*

Notes: Constructed by author using data from U.S. Energy Information Administration[107] on fossil fuel CO2 emissions and real chain-weighted year 2000 dollars from the Council of Economic Advisers.[108]

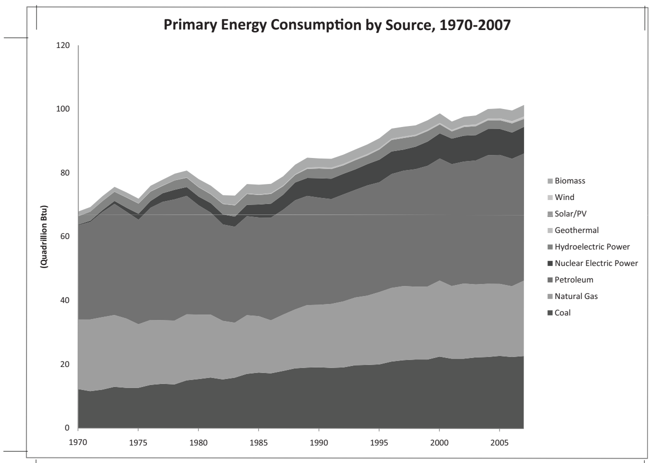


Figure 3: *U.S. Primary Energy Consumption by Fuel, 1970-2007*

Source: U.S. Energy Information Administration.[109]

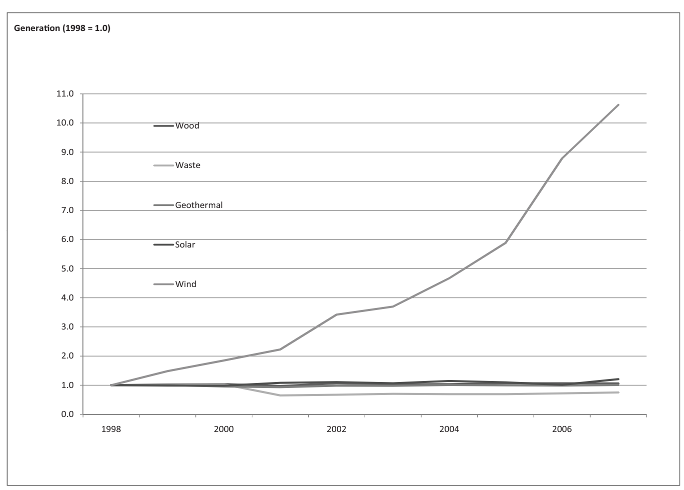


Figure 4: *Non-Hydropower Renewable Electricity Generation, 1998-2007 (indexed to 1998 level)*

Source: U.S. Energy Information Administration.[110]

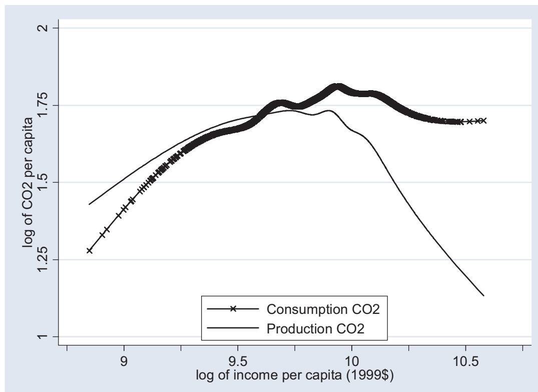


Figure 5: *States' Production and Consumption CO2-income Relationships, 1960-1999*

Source: Aldy.[111]

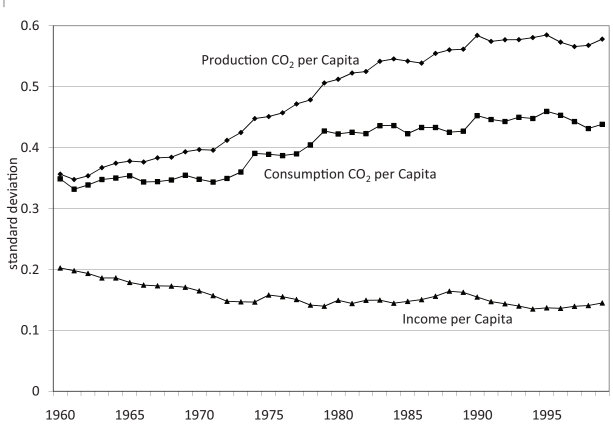


Figure 6: *Dispersion in per Capita CO2 Emissions and Income, 1960–1999*

Notes: Represents the standard deviation of the natural logarithm of CO2 emissions per capita and the standard deviation of the natural logarithm of income per capita. Production CO2 per capita represents the standard measure of emissions based on state of fossil fuel combustion. Consumption CO2 per capita represents a modification of the production measure that attributes the CO2 in electricity production to the state where consumption occurs. Source: Aldy.[112]

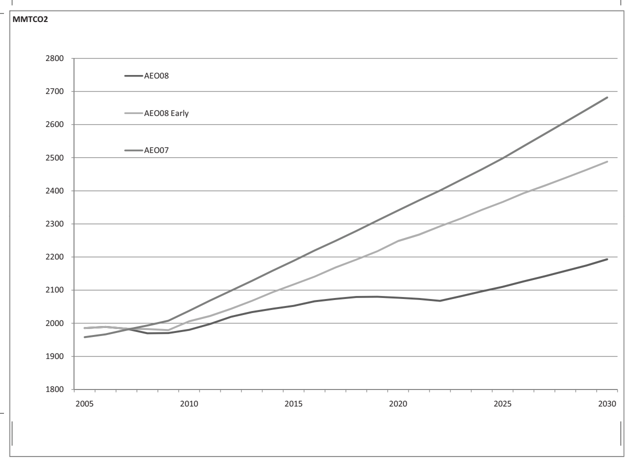


Figure 7: *Forecast Transportation Sector Carbon Dioxide Emissions in Recent U.S. EIA Annual Energy Outlooks*

Notes: Figure presents all transport sector carbon dioxide emissions for the 2007 Annual Energy Outlook, the 2008 Annual Energy Outlook (Early) that does not account for the December 2007 Energy Bill (H.R. 6), and the 2008 Annual Energy Outlook that accounts for the Energy Bill.[113]

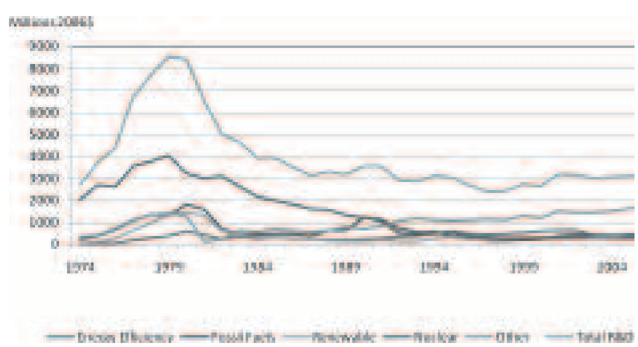
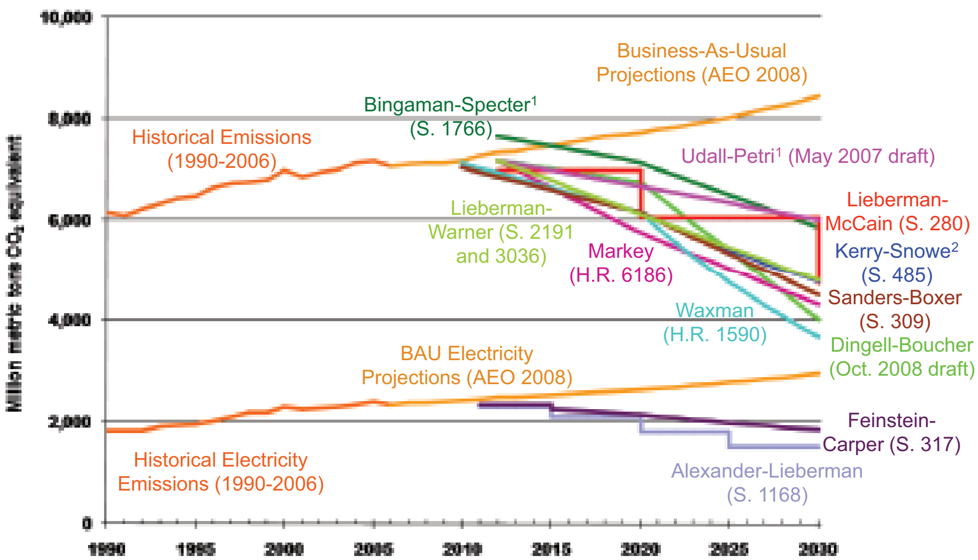


Figure 8: *U.S. Energy R&D Budget, 1974-2006.*

Source: International Energy Agency Access Database.



This graph depicts emissions targets from some of the major climate change bills in Congress. Targets are based on comparison with historical year emissions. Kerry-Snowe, Sanders-Boxer, and Waxman specify future emissions as a percentage of 1990 emissions. For Lieberman-Warner, Lieberman-McCain, Udall-Petri, Bingaman-Specter, Markey, and Dingell-Boucher, emission targets for covered sectors are related to historical emissions for those sectors, and total emissions are assumed to match those in the corresponding historical year.

[1] Bill contains flexibility mechanisms which allow actual emissions to rise above the target.

[2] The Kerry-Snowe target is overlaid by others: it is nearly identical to Sanders-Boxer before 2020 and to Lieberman-Warner from 2020-2030.

Figure 9: *Comparison of Emission Reduction Goals in Legislative Proposals in the 110th Congress*

NOTES

1 Fellow, Resources for the Future; Co-Director, Harvard Project on International Climate Agreements; aldy@rff.org. Josh Blonz provided excellent research assistance on this project.

2 U.S. Energy Information Administration, *Annual Energy Outlook 2008 (*Washington, D.C.: Department of Energy, 2008).

3 Joseph E. Aldy, “Divergence in State-Level Per Capita Carbon Dioxide Emissions,” *Land Economics* 83/3 (2007): 353-369.

4 Joseph E. Aldy, “Energy and Carbon Dynamics at Advanced Stages of Development: An Analysis of the U.S. States 1960–1999,” *Energy Journal* 28/1 (2007): 91–111.

5 Some have performed emission forecasts with such an analysis (e.g., R. Schmalensee, T.M. Stoker, and R.A. Judson, “World Carbon Dioxide Emissions: 1950–2050,” *Review of Economics and Statistics* 80/1 (1998): 15–27.).

6 D. Bodansky, *International Climate Efforts Beyond 2012: A Survey of Approaches* (Arlington, VA: Pew Center on Global Climate Change, 2004).

7 U.S. Senate Committee on Energy and Natural Resources. Responses to “Design Elements of a Mandatory Market-Based Greenhouse Gas Regulatory System,” White Paper, February 2006.

8 See endnote 3 above.

9 Ibid.

10 These state-level emission targets are premised on production measures of emissions as defined in the previous sub-section.

11 For more information about the Regional Greenhouse Gas Initiative, refer to http://www.rggi.org/home.

12 For more information about the Western Climate Initiative, refer to http://www.westernclimateinitiative.org/.

13 For more information about the Midwestern Greenhouse Gas Reduction Accord, refer to http://www.midwesternaccord.org/.

14 Refer to Section 5 for a detailed discussion of cap-and-trade program design issues.

15 Please refer to Section 5 for a discussion of offset projects.

16 D. Burtraw, D. Kahn, and K. Palmer, “CO_2 Allowance Allocation in the Regional Greenhouse Gas Initiative and the Effect on Electricity Investors,” *Electricity Journal* 19/2 (2006).

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02

CLIMATE AND ENERGY: THE EUROPEAN PERSPECTIVE

CLIMATE AND ENERGY - LESSONS LEARNED: THE EUROPEAN PERSPECTIVE

MICHAEL MEHLING AND CAMILLA BAUSCH

Section 1: Introduction

Internationally, the European Union[1] has become known as a forerunner in the adoption and implementation of sustainable energy and climate policies. As will be documented in this essay, Europe has indeed espoused an ambitious agenda, pioneering new policy instruments and voluntarily committing itself to targets both with regard to greenhouse gas mitigation and energy sustainability which exceed those entered by most other industrialized nations. Unsurprisingly, Europe is therefore often said to occupy a leadership position in this area: structurally by virtue of its combined population and economic power and directionally by setting an example with domestic policies and building dynamic coalitions in the international community.[2] Indeed, it has been described as the region that is “doing more than any other part of the world to address global climate change and to share the burdens associated with it.”[3]

For Europe, energy policy has been at the heart of its development into a Community: coming out of a period of devastating conflict in the first half of the twentieth century, and challenged with a comparatively low resource base as well as rapidly growing energy demand, the small group of European nations forming what has become today’s European Union chose energy as one of the initial focus areas for economic and political integration. Recognizing the role of energy as a strategic backbone for any industrialized society, Europe has ever since—albeit not always successfully—sought to achieve greater integration of energy markets and policies. A few decades into the integration process, high population densities and widespread degradation of air, water, and soil as a result of intensive industrialization led to growing public awareness of environmental threats and engendered an active green movement, promoting environmental concerns onto the European political agenda. In many ways, therefore, European leadership in climate and energy policy is an extension of two inherent trends in the larger process of European integration.

Underlying this leadership is a literal proliferation of internal policies and measures on climate change and energy sustainability, including the largest environmental permit trading scheme in history. In 2006, a survey of the European Commission listed altogether thirty-six different measures adopted at the supranational level of the European Union to counter the challenge of global warming,[4] a number which has grown further since the survey was completed. Nevertheless, seeking to realize its ambitious agenda, the Union has encountered a number of difficulties, such as the collapse of market prices for European emission allowances in the same year[5] and not every measure has been uncontested, as became evident with the controversial debate on a mandatory share of biofuels in transport.

Aside from these substantive challenges, Europe also faces a number of structural institutional challenges. European action on climate and energy needs to accommodate a growing array of actors and interests. While per capita energy use and greenhouse gas emissions have remained surprisingly harmonious across Europe, member states are currently on very different emission trajectories, and generally advocate different priorities as regards their energy mix and energy security.[6] In an enlarged Europe of twenty-seven member states, the formulation of a “consensus among many voices”[7] is invariably going to become more difficult, as is already being evidenced by the challenging ratification process of the Lisbon Treaty.

But some of the difficulties encountered by Europe in its efforts to frame an effective climate strategy have also yielded important learning experiences and will arguably prove useful to states currently facing similar challenges. In many ways, such lessons may be of particular relevance to the United States, where numerous climate and energy initiatives are underway at the regional and local level, and where observers expect federal legislation or at least regulation on greenhouse gas emissions in the near future. Careful analysis of the European experience with climate and energy policy can help inform the transatlantic debate, allowing policymakers in the United States to not only better understand the outcomes of European policies, including the success stories and challenges, but also the underlying political dynamics, processes, and actors, an aspect that is also of relevance when seeking to shape international policies.

Accordingly, this essay begins with a short historical outline of European action in the area of climate and energy policy, followed by a survey of the policy framework currently in place in Europe. Drawing on this inventory of existing efforts, the ensuing section sets out a critical assessment of the principal lessons learned in Europe during the elaboration and implementation of its comprehensive policy agenda.

Section 2: Climate and Energy Policy in Europe: A Timeline

FIRST PHASE: FOCUSING ON PEACE AND ECONOMIC INTEGRATION

Energy played an important role in early efforts to promote peaceful cooperation among European nations following World War II. Both the establishment of the European Coal and Steel Community (ECSC) in 1951 and of the European Atomic Energy Community (EURATOM) in 1957 by a small group of western European states[8] were, in part, a response to the vital strategic significance of energy in post-war Europe. Creating a common market for coal and steel was not only seen as a way of promoting trade and economic development through implementation of the fundamental freedoms of the Community, but also as a means of preventing the outbreak of another war: both were vital resources at the time for any country to engage in military aggression.

Likewise, EURATOM was mandated with the promotion of nuclear energy for peaceful purposes and the commitment to uniform safety standards. As such, both initiatives reflected the priorities of the time: peace and economic integration, two objectives that were further promoted with the creation of the European Economic Community (EEC) in 1957. In effect, the European Commission itself has observed that "as far back as 1954, energy was regarded as one of the motors of European integration since it is at the heart of economic activity and social welfare and because it is a key factor in Community solidarity."[9] By contrast, the environmental implications of energy production and use did not receive much attention in Europe at that stage.[10]

But despite the creation of the ECSC and EURATOM, progress toward the integration of energy policies remained slow due to the absence of explicit legislative powers for the European legislature. Energy continued to represent an important aspect of national security, and member states had little interest in devolving their sovereign power to decide on energy policies to Brussels.[11] Attempts by the Commission to further a common market for energy to better address consumer needs and competitive pressures remained largely ineffective.[12]

It was not until the oil crisis of the early 1970s, which underscored the value of European cooperation for improved energy security, that member states decided to explore more active engagement and define the cornerstones of a common energy policy.[13] Building on existing competences to establish an internal market for goods and services, the Community adopted a number of measures relevant to the production, distribution, and use of energy. On the supply side, however, the member states remained hesitant to approve policies at the European level, merely agreeing to maintain minimum oil stocks and to establish contingency plans in the event of another oil crisis.[14]

The adoption of the Single European Act in 1987 introduced a new chapter on environmental protection into the establishing treaty of the Community and thereby created an important basis for legislation on energy efficiency and sustainable energy use. By this time, environmental concerns had become an important focus of European governance, resulting in the adoption of a large number of measures on conventional environmental challenges, such as air, water, and soil pollution; waste management; and nature conservation. When the Maastricht Treaty further promoted the passage of environmental legislation in 1992 by introducing majority voting procedures and more active participation for the traditionally progressive European Parliament, environmental policy in the member states soon became dominated by measures originating in Brussels.

Although discussed at the European level since the late 1970s, climate change was not initially framed as a relevant policy issue. Still, the transboundary nature of the climate challenge and its underlying causes, along with an interest in maintaining a level playing field for economic activities in Europe, provided a compelling argument for Community action on climate change. In 1986, the European Parliament adopted its first resolution on climate change, while the Council passed a—legally non-binding—resolution to improve the energy efficiency of final energy demand by 20 percent until 1995, thereby defining an efficiency target rather than a conservation target.[15] At this early stage, such measures addressing energy demand were not yet considered part of a coherent climate policy; still, given the indivisible connection between energy and climate change, they can nevertheless be counted among the earliest European efforts to address the emerging challenge of climate change.

A new dynamic followed when the Environment and Energy Councils issued a joint agreement in 1990 to stabilize carbon dioxide emissions at 1990 levels by 2000.[16] By this point, climate change was meeting with increased concern of an environmental movement that had successfully campaigned against conventional pollutants and nuclear energy in Europe during the 1980s, and that was now arguably becoming increasingly aware of this new issue for its agenda. Nevertheless, climate change had not yet become a priority issue for the broader public or the media.

With climate change increasingly recognized as an environmental threat, pertinent legislation in the following two decades was generally adopted under the flexible powers on Community environmental policy. Meanwhile, for measures affecting the energy market—especially with a view to integrating European markets and grids—another path was chosen. The reason for this was simple. Already, the responsibility for environmental policy had been shared by the Community and its member states, whereas no explicit legislative power existed for energy policy; moreover, environmental measures “significantly affecting a member state’s choice between different energy sources and the general structure of its energy supply” required a unanimous vote in the Council. Accordingly, issues relating to the internal energy market were henceforth pursued under a largely separate agenda and institutional framework than issues relating to climate change. Any attempts to integrate climate and energy—such as an initiative of the European Commission to “establish a broad common understanding ... on main orientations concerning energy and the environment”[17]—did not meet with much success,[18] arguably because member states remained reluctant to share competences in the energy sector.

SECOND PHASE: CLIMATE CHANGE AS AN ENVIRONMENTAL CHALLENGE

Concerns over the possible threat of climate change led the World Meteorological Organisation (WMO) and the United Nations Environment Program (UNEP) to establish the Intergovernmental Panel on Climate Change (IPCC) in 1988. Its stated objective was to assess the reality of climate change based on peer-reviewed and published scientific literature. The IPCC delivered its first Assessment Report in 1990 and a supplementary report in 1992 to contribute to the negotiations on the Framework Convention on Climate Change[19] at the Earth Summit[20] later that year in Rio de Janeiro. With these reports, the evidence for anthropogenic interference with the climate system became increasingly apparent. For policymakers, moreover, they constituted a vital source of information.

In the same year that the international community adopted the UNFCCC, the European Commission proposed a strategy to limit carbon dioxide emissions and improve energy efficiency.[21] With its fifth Environmental Action Program, moreover, the Commission defined climate change as one of seven “themes” for European Community environmental policy, listing central objectives and types of actions for numerous sectors.[22]

In 1993, the Community adopted a greenhouse gas monitoring mechanism[23] as a first measure to ensure achievement of the commitments entered under the UNFCCC. Previously, it had already implemented measures on the promotion of energy efficiency projects[24] and a framework directive on energy labeling.[25] Nonetheless, attempts to implement a carbon and energy tax as the centerpiece of European climate policy failed due to insufficient support from the member states, with fiscal measures requiring formal unanimity in the Council.[26] Such lack of enthusiasm in the member states also extended to the other measures, and European emissions would have grown considerably throughout the early 1990s without the "wallfall profits" of industrial collapse in eastern Germany after reunification, the British "dash for gas" following the defeat of coal miners in a series of strikes throughout the 1980s and subsequent introduction of cheap North Sea gas, and finally a broader economic slowdown.[27]

Renewed impetus followed from the adoption of the Kyoto Protocol in 1997.[28] Within the overall reduction targets for greenhouse gases set out by the Protocol for its first commitment period, the European Union bound itself to a reduction of 8 percent, accepting the highest reduction target among major industrialized countries. Using an option to meet commitments jointly under the Protocol, the individual efforts of each member state were distributed through a burden-sharing agreement,[29] which accounted for domestic circumstances such as the expectation for economic growth, the prevailing energy mix, and the structure of the industrial sector.[30] A result of intense political negotiations, this arrangement helped Europe accommodate very different factual circumstances and levels of ambition while maintaining a common position at international negotiations.

By introducing quantified emission limitation and reduction objectives, the Kyoto Protocol set out binding obligations whose observance became objectively measurable; moreover, because the Protocol had been adopted as a "mixed agreement," that is, an agreement adopted by both the European Community and all its member states simultaneously,[31] a violation would pose a breach of international law both by the member states which failed to meet their respective burden-sharing targets and the Community in its entirety. Given the threat of sanctions, whose effectiveness may admittedly be questioned, this provided an additional incentive for ambitious climate policy efforts throughout Europe.

Responding to this challenge, the Commission launched the European Climate Change Program (ECCP) in early 2000 with the overall objective of identifying and developing "all those elements of a European Climate Change strategy that are necessary for the implementation of the Kyoto Protocol."[32] As part of this strategy, the Commission identified a list of "proposed Common and Co-ordinated Policies and Measures on Climate Change" for various sectors, focusing on energy, industry, and transport. In accordance with the legislative roadmap set out by the ECCP, the Commission proceeded to draft a number of measures on energy labeling and ecodesign requirements, energy services, renewable energy sources, energy taxation, research funding, and emissions trading.[33]

In 2002, the sixth Environmental Action Program, which set out the general strategic framework for European environmental policy over the following decade, declared climate change one of four priority areas. It specified that climate policy in Europe should be guided by "a long term objective of a maximum global temperature increase of 2 degrees Celsius over pre-industrial levels,"[34] an aim which should be promoted, *inter alia*, through "realisation by 2005 of demonstrable progress in achieving the commitments under the Kyoto Protocol." With a view to operationalizing these strategic objectives, the Action Program outlined a number of general and sector-specific measures, including an assessment of results achieved under the ECCP. Aside from this comprehensive mitigation strategy, it also mentioned adaptation needs, albeit without going into much detail.

Climate change, at least as far as greenhouse gas mitigation was concerned, had clearly become part of a comprehensive regulatory strategy at the European level. Yet even this proliferation of individual measures was unable to reverse emission trends altogether in Europe: by 2005, the statistical agency Eurostat reported that "both greenhouse gas emissions and energy consumption have increased since 2000" and several member states "are moving away from their agreed targets."[35] Increasingly, it became clear that the existing European policy framework was insufficient to ensure compliance with the mandatory commitments entered under the Kyoto Protocol.

THIRD PHASE: FROM PARALLEL REGULATION TO INTEGRATED GOVERNANCE

In view of the foregoing trend, the European Commission developed the second ECCP in 2005.[36] With this program, which created working groups on five different issue areas to provide input for new legislation, the Commission sought to address perceived shortcomings of the first ECCP. These five issue areas were transport, energy supply, energy demand, non-CO_2 gases, agriculture, and intensified action with regard to aviation, cars, carbon capture and storage, adaptation, and emissions trading. As such, the second ECCP reflected awareness that a successful policy framework would have to bridge the existing divide between environmental policy and energy and transport policy, which manifested itself in separate legislative agendas and institutional responsibilities, while also ensuring coherence between a growing number of separate instruments, targets, and institutions. Essentially, the policy responses to energy and climate challenges—which had largely evolved separately and within the institutional purview of two different Council formations and separate departments at the European Commission—would have to become more streamlined and ultimately integrated.

Building on a prior consultation process, the Commission followed up in 2007 with a landmark document setting out its proposal for a comprehensive integrated climate and energy policy.[37] Described as a "watershed" in European energy and climate policy,[38] this document represents the first cooperative effort by two Commissioners—the Commissioner for Energy Policy and the Commissioner for the Environment—to formulate a joint and comprehensive response to the challenges of climate change and energy sustainability. Specifically, it outlines a strategy to strengthen the internal market for energy and security of supply by, *inter alia*, asking for clearer separation of energy production from energy distribution and harmonized regulatory control of the grid. Likewise, it encompasses issues relevant for both the energy sector in general and climate protection, such as increased spending on energy research or the incorporation of carbon capture and storage into the emissions trading scheme. Last but not least, the document elaborates explicitly on measures to mitigate global warming, most prominently by asking for quantified emission reduction targets.

Regarding the latter, the Commission proposed a set of percentage targets to be achieved by 2020: a firm and independent commitment to reduce greenhouse gas emissions by 20 percent relative to 1990 levels, and a commitment to reduce emissions by up to 30 percent if an international climate protection regime sets comparable ambitious targets for other countries; a mandatory target of 20 percent for the share of renewable energy in the overall energy mix; a legally binding—albeit conditional—target of 10 percent for the share of biofuels in transport fuel; and an objective to reduce primary energy consumption by 20 percent compared to projections for 2020 through improved efficiency. Achievement of these ambitious objectives should ensure that Europe is transformed "into a highly energy efficient and low CO_2 energy economy, catalyzing a new industrial revolution, accelerating the change to low carbon growth and, over a period of years, dramatically increasing the amount of local, low emission energy that we produce and use."[39] Here, the word "local" underlines how this strategy also incorporates aspects of energy security and independence.

Before acquiring politically binding effect, this proposal had to be adopted by the member states. With strong endorsement from the Chancellor of Germany, Angela Merkel, who held the EU Presidency at the time, all heads of state in the European Union agreed to this policy strategy at the Spring European Council, including, most importantly, the adoption of the quantified "20/20/20" targets it set out.[40] But while these targets set an important frame of reference and underlined the level of ambition Europe was prepared to follow, an even greater challenge now had to be resolved: rendering these targets operational with concrete measures and, arguably even more difficult politically, distributing the burden of reaching these targets among the individual member states.

On 23 January 2008, the European Commission announced a set of legislative proposals–including the revision and update of central elements of existing European climate legislation–to implement each of the foregoing targets and objectives. Proposals in this package included a sweeping reform of the emissions trading scheme, domestic emission targets for sectors not covered by the scheme, revised legislation on the promotion of renewable energy including biofuels in the transport sector, and a legal framework for Carbon Capture and Storage (CCS) activities.

Overall, these proposals shift more responsibility to the European level, e.g., as caps for greenhouse gas emissions in a number of sectors are defined in Brussels, and encourage a new market for renewable energy certificates.[41] Initial reactions from the member states and European institutions suggested that the Commission proposals had found a right balance between ambition and flexibility, although several aspects of the package—including the internal distribution of emission reduction efforts and renewable energy targets—have proven difficult to agree on. Any delays would be critical, as the aim was to finalize the legislative process before the end of 2008, before the upcoming election of the European Parliament in spring 2009, and in time to prove the EU´s ability to deliver at the international climate negotiations in Poznan in December 2008.[42]

Still, many more concerns remain. As the world moves closer to the climate negotiations in Copenhagen in late 2009, when the international community expects to adopt a new climate regime for beyond 2012 (the expiration of the first Kyoto commitment period with its binding targets), Europe has to show whether it can maintain its credibility by meeting its own goals and commitments, and display sustained leadership domestically and internationally. As outlined in the following sections, Europe has a solid policy framework to draw upon, and has also learned important lessons from earlier mistakes; yet at the same time, new challenges will join a number of unresolved issues going forward, and it is difficult to predict what the future role of the European Union will be both in the medium and the long term.

Section 3: The Current Policy Framework: Actors, Principles, and Instruments

ACTORS AND PROCESSES

The Actors: Institutions, Networks, and the Member States

When seeking to understand the European Union and its policies, it is essential to bear in mind that this alliance of twenty-seven sovereign states is home to roughly 500 million people embracing highly diverse cultural backgrounds, with per capita gross domestic product ranging from €59,202 in Luxembourg to €7,913 in Bulgaria.[43] Such national variation also extends to the realm of energy and climate change in individual member states, with substantial differences in the distribution of energy sources, the success in market liberalization, and the efforts needed for—and indeed the degree of—achievement of supranational climate commitments. Some member states take a more active role in forging climate and energy policies evolving in Brussels, while others revert to a largely passive or defensive role. Views on nuclear energy differ considerably, as does support for renewable energy and carbon capture and storage technologies.[44] One aspect shared by almost all member states, however, is a high dependence on foreign energy imports: imports currently account for 54 percent of energy consumed in the European Union,[45] although considerable differences exist between the dependence levels of different member states.

Assessing the economic and political realities in different member states is not the purpose of this report. But still, despite being endowed with certain genuine legislative powers, the European Union and its lawmaking process are largely driven by the member states. In the context of climate and energy policy, national interests retain particular weight because these are areas of shared competence, where the domestic sovereignty of member states clashes with the limited powers conferred to the European legislature. As a result, climate and energy policy in Europe forms a prime example of multi-level governance, involving a complex distribution of powers and responsibilities between the European level and the member states.[46]

Member state positions and priorities are channeled through the "Council of the European Union," which is also the main decision-making body. Essentially, the Council brings together the national ministers responsible for a particular issue, such as energy or the environment, to decide on legislation and political strategy. The two most important ministerial Council formations for climate and energy policy are the Environment Council and the Transport, Telecommunications, and Energy Council. Increasingly, however, the issue is considered relevant enough for central decisions—for instance, on the overarching objectives and principles—to be adopted at the level of the European Council, which is the meeting of the heads of state and government.

An influential role in setting the climate and energy agenda has also been exercised by the Presidency of the Council, which is a rotating function held by the government of a single member state for a term of six months, entailing the responsibility to prepare and chair Council meetings and be the contact point toward the Parliament.

Common policies on climate and energy are generally adopted in a joint procedure—the co-decision procedure—of the Council with the European Parliament, which has the right to veto legislative initiatives. Members of the European Parliament tend to vote according to political allegiance rather than domestic positions. Plenary decisions are prepared in a number of specialist committees, where appointed rapporteurs elaborate the substantive position of the Parliament and suggest amendments to legislation proposed by the Commission and endorsed by the Council.

Of these committees, two are of particular importance for the climate and energy debate: the Committee on Environment, Public Health, and Food Safety and the Committee on Industry, Research, and Energy. Mirroring a similar development in the U.S. House of Representatives, moreover, the Parliament created a Temporary Committee on Climate Change—albeit only with an advisory mandate—in 2007. On environmental matters, including climate change, the European Parliament is generally considered a progressive force, often insisting on more ambitious measures than those favored in the Council by member states.

But neither the Council nor the Parliament has the right to initiate legislation: this is an important prerogative of the European Commission, which is the executive arm of the Union. Although it consists of appointees from the member states, it is designed to be independent of national interests. Within the Commission, climate and energy policies mainly fall within the purview of the Commissioner on Environment and the Commissioner on Energy and Transport, with each receiving support from professional staff in the various Directorates General.

Like the Parliament, the Commission is known to pursue an ambitious agenda in energy and climate change, both when it comes to proposing legislation and overseeing its eventual implementation by the member states. Still, internal disagreement between different services—notably the Directorate General Environment and the Directorates Enterprise and Industry and Economic and Financial Affairs—have occasionally tempered this profile.[47]

Further relevant functions include the administration of substantial research funding through the Directorate General Research and the compilation of data through the Statistical Office of the European Communities (Eurostat). Other important actors include the European Environment Agency (EEA), an agency devoted to monitoring the state of the environment in Europe. In exercising its mandate, it publishes regular reports on greenhouse gas emission trends and the implementation of common climate and energy policies in Europe, partly drawing on support from the European Topic Center on Air and Climate Change (ETC/ACC). Also worth mentioning are the European Court of Justice and the Court of First Instance, which have both issued several important decisions relating to the implementation and enforcement of European climate and energy legislation in the member states, including, lately, on domestic implementation of the European emissions trading scheme and actions initiated by different member states to challenge allocation decisions by the Commission.[48]

Finally, the fragmented nature of institutional structures in Europe provides multiple channels for organized interests to influence policymaking in the European Union. Accordingly, Brussels and Strasbourg—the seats of the European Commission and the European Parliament—have witnessed a rapidly growing and highly professional network of formal and informal groups representing civil society and business interests, such as the European Environmental Bureau, an umbrella federation of more than 140 environmental citizen groups, or various trade and labor federations, such as the Confederation of European Business (BusinessEurope) and the European Trade Union Confederation. More than other issue areas, arguably, climate and energy policy have been heavily influenced by the lobbying efforts of these various groups.

The Process: Legislation, Negotiation, and Treaty Reform

Applicable legislative procedures depend on the policy area in question and the nature of the proposed measures. Legislation on climate and energy will typically be adopted in a process involving several stages, starting with a request by the Council or Parliament for a legislative draft. Once a proposal has been drafted by the Commission, often based on earlier policy documents—such as Green and White Papers—and stakeholder consultations, it will be considered in the Parliament and Council. Legislation introducing fiscal measures of environmental policy or significantly affecting the structure of energy supply in the member states requires unanimity in the Council, and only involves a consultation of the Parliament.

In a majority of cases, however, the co-decision procedure applies, allowing both the Council and the Parliament to propose amendments, and requiring them to agree on an identical text before the proposal can be adopted. Here, the Council votes with qualified majority, whereas the Parliament can only reject a proposal with absolute majority. If the differences cannot be resolved, a Conciliation Committee will convene and try to save the initiative. Still, in recent years, both institutions have tended to reach early agreement, with an average length of the legislative procedure between one and two years.[49]

A special procedure applies to the negotiation of international agreements. While the Commission is formally charged with negotiations, it acts on the basis of a mandate formulated by the Council. Also, it has become common practice for member states to be fully integrated in the negotiation process. During the actual conferences, however, the European Union and its member states will usually speak with one voice, that of the Presidency.[50] Both the UNFCCC and the Kyoto Protocol have been adopted simultaneously by the European Community and the member states, and the same will likely apply to any successor treaty on a future climate regime under the UN. As mentioned above, under such "mixed agreements," the Community and the member states are each responsible for full observance of the commitments therein.[51]

Overall, each phase in the evolution of the European Union—from the Single European Act (1986) to the treaties of Maastricht (1992), Amsterdam (1996), and Nice (1999)—has tended to strengthen its weight and influence vis-à-vis the member states.[52] An expanding institutional mandate, greater responsibilities, and new areas of integration have created a unique political dynamic that goes beyond a mere common denominator of national positions. Both the European Parliament and the Commission have actively embraced the climate and energy debate as an opportunity to further their influence and respective political agendas.

If the Treaty of Lisbon signed by European heads of state and government in December 2007 enters into force, European governance will be further strengthened, with institutional changes including an elected President of the European Council and further legislative privileges of the Parliament. For the first time, moreover, the Treaty of Lisbon would include an explicit legislative mandate on energy policy, committing the Union to "promote energy efficiency and energy savings and the promotion of new and renewable forms of technology," and also mention climate policy as one of the objectives of the Union. These changes would enhance the power of the Commission to initiate stringent climate and energy legislation by offering a clear legal basis for reform, outside of the political agreements reached at individual European Councils. After the rejection of the Treaty by the Irish electorate at the referendum of 12 June 2008, however, its entry into force remains uncertain for the time being.

PRINCIPLES AND OBJECTIVES

Ensuring sustainability, security of supply, and competitiveness are the three overarching objectives of European climate and energy policy.[53] As early as 1996, moreover, the Council declared that it "believes that global average temperatures should not exceed 2°C above pre-industrial levels,"[54] a position it has upheld with the European Parliament and the Commission ever since.[55] As mentioned earlier, a central pillar in the European effort to achieve this target are the "20/20/20" objectives endorsed by the heads of state and government in March 2007. On a broader level, these objectives are flanked by the general purposes of the European Community, which include the promotion of a harmonious, balanced, and sustainable development of economic activities, sustainable growth, and a high level of protection and improvement of the quality of the environment and human health. For energy, moreover, the objective of prudent and rational utilization of natural resources is important.

Additionally, a range of principles guide the elaboration and implementation of common policies and measures. In areas of shared competence, such as climate and energy, the principles of subsidiarity and conferred powers govern the distribution of responsibilities between the European Community and the member states. Under these principles, the European Community shall only act within the limits of the powers conferred upon it and if and insofar as the objectives of the intended action cannot be sufficiently achieved by the member states, but can rather, by reason of the scale or effects of the proposed action, be better promoted at the European level. Moreover, such action needs to adhere to the principle of proportionality, meaning that it may not go beyond what is necessary to achieve said objectives.[56] Following the adoption of the Kyoto Protocol and European efforts to harmonize national climate strategies under a "common and coordinated" policy framework, these principles were frequently invoked in hopes of limiting a perceived encroachment on domestic sovereignty.[57]

Any policies relevant to environmental protection need to be based on the precautionary principle, the principle that the polluter should pay, and the principle of integration.[58] Under the precautionary principle, preventive action should already be taken where scientific evidence is still insufficient, inconclusive, or uncertain, but preliminary scientific evaluation indicates that there are reasonable grounds for concern about the potentially dangerous effects on the environment and human, animal, or plant health.[59] Given the complexity of climate change, its causes, and its consequences, this principle has been of particular importance in justifying action prior to the achievement of full scientific certainty. Internalization of the external costs of environmental pollution in the cost of production or the price of a product is promoted by the principle that the polluter should pay, a notion that finds its reflection in economic and market-based instruments such as energy taxation and the emissions trading scheme.[60] And finally, the principle of integration, which requires environmental protection requirements to be integrated into the definition and implementation of all other Community policies and activities, is important for a cross-cutting issue such as climate change, as it calls for better consideration of environmental impacts in policy areas such as transport, energy, or agriculture. It is this rationale which has also prompted the recent integration of climate and energy policies at the European level, both at the substantive and at the organizational levels.

POLICIES AND MEASURES

Lawmaking by the European Community is confined to a strictly defined typology of legal instruments: regulations, directives, decisions, and—as legally non-binding instruments—opinions and recommendations. By far the most common vehicle for climate and energy policies is the directive, which requires member states to achieve a specified result while allowing them discretion in their choice of forms and method to achieve the result. Details of implementation are thus left to the national authorities. Regulations, by contrast, become applicable law in all member states the moment they enter into force, without requiring further implementing measures. Moreover, they automatically override conflicting domestic provisions. Decisions are binding, but more limited in scope; they could, for example, aim at a single member state only, and were used to implement, for instance, the sixth Environmental Action Program and to adopt the Kyoto Protocol for the European Community. Non-binding recommendations and opinions have not played an important role in energy and climate policy at the European level. The following sections contain an overview of the main policies and measures adopted by the European Community on energy and climate policy.

Emissions Trading

One of the measures already envisioned by the first ECCP and the sixth Environment Action Program was the introduction of emissions trading as a policy instrument to mitigate greenhouse gas emissions at lower economic cost. After intense discussions with stakeholders, the European Parliament and the Council adopted a directive in late 2003,[61] establishing a regulatory framework for trade in greenhouse gas allowances.[62]

Since 1 January 2005, operators of almost all installations in the energy sector as well as large parts of industry—representing almost half of overall CO_2 emissions in Europe—have been required to participate in the trading regime. Covered installations are required to obtain a permit for their CO_2 emissions, and must surrender a sufficient number of allowances each year to cover their emissions during the preceding year. Allowances can be transferred among market participants, with market integrity ensured by national registries and a Central Administrator tracking the circulation and possession of allowances.

As with most community policies, member states enjoyed considerable discretion in the operational implementation of this directive. Arguably the most consequential feature left to their discretion was the determination of the emission ceiling—or "cap"—reflected in the number of allowances allocated as well as the allocation methodology, for which the directive merely specifies general criteria and a limit on the share of auctioning. National Allocation Plans (NAPs) have been submitted and approved by the European Commission for the first (2005-2007) and second (2008-2012) trading period.

Not surprisingly, implementation of the emissions trading directive has been a significant challenge for all member states. Windfall profits due to a specific way of allowance allocation and a lack of international competition in the energy sector, as well as a collapse in market prices during the first trading period, yielded a number of difficult lessons, and allocation for the second trading period as well as a proposed reform for the period beyond 2012 have clearly sought to address underlying shortcomings.[63] Largely stable prices for the current trading period suggest the scheme has successfully emerged from the initial "learning phase"; more importantly, however, the trading scheme has also created the largest transboundary market for tradable pollution rights, thereby contributing to the birth of a new global commodity: carbon.

An international dimension was added to the trading scheme by way of an amendment, known as the "Linking Directive," which integrates the project-based mechanisms of the Kyoto Protocol with the European market for emission allowance.[64] Essentially, this amendment allows operators in the emissions trading scheme to use credits from the Clean Development Mechanism (CDM) and Joint Implementation (JI) for compliance purposes, although with several limitations. Specifically, it excludes credits from nuclear energy, land use, land-use change and forestry activities, and imposes additional criteria for large-scale hydroelectric projects.

Clearly, the Linking Directive has greatly increased the demand for project credits: before it entered into force, interest in the project-based mechanisms was still fairly modest, given the absence of major domestic carbon markets. In the meantime, however, the European Union has become a major price driver in the international carbon market. In view of growing concerns over the environmental integrity and geographic distribution of eligible projects, however, this effect has not been free of controversy.

Taxation of Energy Products

Before the European Commission turned to emissions trading as the cornerstone of its climate strategy, it had long sought to implement a comprehensive scheme for carbon and energy taxation. After the failure of repeated attempts to push relevant legislation through the Council, the Commission proposed a less ambitious directive establishing very low minimum tax rates for energy products.[65] Under the directive, energy products are only subject to taxation if used as motor fuel or heating fuel. Fuel used for industrial, commercial, and heating purposes is subject to preferential rates, and member states may apply further exemptions, for instance to promote public transportation or renewable energy sources. For the time being, however, energy products used for international air and maritime transport are excluded from the directive.

Renewable Energy and Biofuels

Although the European Community has been traditionally cautious when influencing the energy supply in member states, it already recognized in the 1990s that an expanded share of renewable energy sources in the overall energy mix would be an important condition for the achievement of international greenhouse gas reduction goals and greater energy independence. In 1997, the Commission therefore published a comprehensive White Paper for a Community Strategy and Action Plan,[66] one consequence of which was the adoption of legislation on the promotion of electricity produced from renewable energy sources.[67]

Adopted in September 2001, this directive addresses targets for both the gross consumption of renewable energy in general and the consumption of renewable electricity. Regarding the latter, the directive addresses power produced from renewable energy sources such as wind, solar, geothermal, wave, tidal, hydroelectric, biomass, landfill gas, sewage treatment gas, and biogas energies. It requires member states to set indicative targets for renewable electricity consumption. If all member states achieve their national targets, the share of electricity produced from renewable energy sources in gross electricity consumption should rise to 22 percent by 2010.

Additionally, the directive provides for a system of mutually recognized guarantees of origin to facilitate the exchange of electricity generated from renewable sources and increase transparency for informed consumer choice. The guarantees of origin indicate both the renewable energy source from which the electricity is produced and the date and place of production.

In May 2003, moreover, the Community also adopted a directive on the promotion of renewable fuels for transport aimed at "promoting the use of biofuels or other renewable fuels to replace diesel or petrol for transport purposes." It covers a wide range of biofuels, such as biogas, biodiesel, bioethanol, biomethanol, and biohydrogen, and requires member states to set national targets for a minimum share of biofuels and other renewable fuels on their markets. Reference values for the targets are set at 2 percent by 31 December 2005, and 5.75 percent by 31 December 2010.

While the share of renewable energy sources has jumped by more than half since 1997, the indicative target of 12 percent share of renewable energy in gross inland consumption by 2010 will not be achieved.[68] In part, this can be ascribed to the only aspirational nature of these targets, and the ample discretion afforded to member states in their implementation. Here, too, the Community has responded with a comprehensive reform proposal addressing these shortcomings.[69]

Energy Efficiency

Aside from addressing the structure of energy supply, energy policies can also seek to influence energy demand and promote its efficient use by imposing energy efficiency requirements in various fields. A central measure with horizontal scope was adopted in 2006 with the directive on energy end-use efficiency and energy services.[70] If fully implemented, the Commission estimates that this measure alone could reduce European greenhouse gas emissions by almost 10 percent compared to 1990 levels by 2020.[71]

The directive sets out conditions for the development of a market for energy services[72] and the delivery of other energy efficiency improvements to final consumers in general. Member states are required to adopt an indicative overall energy-savings target of 9 percent for 2016, prepare national energy efficiency action plans for the public sector, and enable final consumers to make more informed decisions on their individual energy consumption through information on available energy efficiency improvements, technical specifications for energy-using equipment, and better metering and billing of energy consumption.

Most measures of the European Community, however, target specific areas focusing on buildings, energy generation, transport, and energy-using products. As in other parts of the world, buildings offer the greatest demand reduction potential, notably through improved insulation and more efficient appliances and heating and cooling systems. Over time, the European Community has adopted a fragmented array of measures relevant to the energy efficiency of buildings, for instance on boilers, construction products, and energy certification, seeking to harness this substantial potential.

In December 2002, these various initiatives were successfully integrated into a comprehensive directive on the energy performance of buildings,[73] which sets out a harmonized calculation methodology and minimum standards for the energy performance of new buildings and existing buildings undergoing major renovation in the residential sector and the tertiary sector. Further elements of the directive are a system for energy certification, requiring openly visible certification of public buildings, and regular inspection requirements for boilers and central air-conditioning systems as well as old heating installations. Yet, many potential avenues to improve energy efficiency have remained untouched due to economic or political considerations, for instance in the existing buildings stock; there, a major obstacle has been the high level of divergence between real estate ownership and tenancy, with investments in efficiency improvements typically benefitting the tenant and not the owner financing the investment

Another important sector is transport, which was featured in some of the earliest common policies of the Community. Still, for the most part, European transport policy has been focused on the removal of obstacles to the free movement of persons and goods across member state borders. It is also highly relevant at a political level, accounting for a significant portion of employment and investment in the European Union, and has therefore proven notoriously difficult to regulate. Already about decade ago the European Council set a goal of reducing emissions of CO_2 from new cars to 120 g/km, largely basing its strategy on voluntary agreements with automobile manufacturers associations while the Community adopted in parallel a fuel economy labeling scheme and a CO_2 monitoring mechanism for new cars,[74] but neither delivered the emission reductions hoped for.

When it became evident that the voluntary agreements with manufacturers would not be observed, the Commission responded on 20 December 2007, with a proposal for binding legislation setting out detailed measures to reach the objective of average emissions for the new car fleet of 120g/km by 2012.[75] Currently still in the legislative process, this proposal—particularly its compliance deadline and the penalties (fines for excess emissions) it would impose—has sparked violent protest from the automobile industry and controversial discussions among member states, notably with Germany opposing the proposed emissions limitation. Preliminary votes in the European Parliament Committee on Industry, Research, and Energy and the Committee on Environment, Public Health, and Food Safety in September 2008 reflected divergent priorities between ensuring relevant emission reductions and protecting the interests of automobile manufacturers; a plenary vote is scheduled for 16 December 2008.

For the energy sector, Europe adopted a directive on the promotion of combined heat and power generation in 2004.[76] Also referred to as cogeneration, combined heat and power is a process which allows for increased efficiency by simultaneous generation of thermal and mechanical or electrical energy. Rather than setting out binding targets, the directive calls on member states to evaluate their national potential for cogeneration and establish adequate support schemes. On the basis of harmonized reference values determined by the Commission, member states must ensure that the origin of electricity produced from high efficiency cogeneration can be guaranteed using objective, transparent, and non-discriminatory criteria.

Finally, in 2005, the European Community adopted a directive harmonizing the definition of eco-design requirements for energy using products in the residential, tertiary, and industrial sectors.[77] Specifically, the directive "provides for the setting of requirements which the energy-using products covered by implementing measures must fulfill in order for them to be placed on the market […] or put into service." It covers all energy-using products regardless of energy source, and does not itself introduce binding efficiency standards, but leaves this task—along with conformity assessments and corresponding labeling and declaration duties—to the member states. Additionally, the European Union is engaged in voluntary labeling initiatives, such as the "Energy Star" program partnered with the United States.

Research and Development

Research on energy and climate change is promoted through various channels in the European Community. Most research funding is bundled under the Seventh Framework Program for Research and Technological Development (FP7), which spans the period between 2007 and 2013. Its objectives are to further the construction of the European Research Area and enhance research and innovation capacity throughout Europe. Eligible addressees are, of course, primarily research groups at universities or research institutes, but also companies intending to innovate and public or governmental administration.

The fixed total budget for FP7 is €51 billion over the duration of the program, of which roughly two-thirds are allocated for transnational research activities, such as collaborative research projects, networks of excellence, and support and coordination actions. A percentage of funds is allocated to climate change (approximately €2 billion) and energy, excluding nuclear energy (approximately €2.3 billion). Separate funds of approximately €2.8 billion are available under EURATOM for research on nuclear technologies in the areas of fusion and fission, including radiation protection, infrastructure, and waste as well as training for the period between 2007 and 2011. Additional funds are earmarked for enhancing research infrastructures, but also for measures to support the training, mobility, and career development of European researchers.

In parallel to this major source of research funding, a multiannual program for action in the field of energy titled “Intelligent Energy—Europe” was adopted by decision in June 2003.[78] It provides a framework for support measures in the area of energy, particularly in the field of energy efficiency and renewable energy sources. Originally, it was set to last only until 2006, but was later extended under the Competitiveness and Innovation Framework Program to continue until 2013. Against the backdrop of an earlier evaluation carried out by an independent panel of experts, which recommended widening financial support in the area of energy, the decision grouped already existing measures together in a single program covering four specific fields: renewable energies (ALTENER), the rational and efficient use of energy (SAVE), energy aspects of transport (STEER), and the promotion of renewable energy sources and energy efficiency in developing countries (COOPENER).

In these areas, funding can now be granted to actions or projects with the objective of promoting energy efficiency; the increased use of renewable energy sources and energy diversification; the development of means and instruments to follow up, monitor, and evaluate the impact of the measures; and efficient and intelligent patterns of energy production and consumption through improved awareness and greater information exchange. So-called “key actions” may combine several of these areas or relate to priority objectives of Community policy. The amount of financial assistance is dependent on the benefit and expected outcome of the proposed activity, with priority usually afforded to small and medium-sized enterprises and regional or local initiatives. Typically, the financial aid granted under this program will cover no more than half of the total costs of a project or action. An overall budget of €930 million has been allocated for these purposes since 2003.

Section 4: Lessons Learned

EMISSIONS TRADING: THE VALUE OF LEARNING BY DOING

No assessment of European energy and climate policy can avoid discussing the remarkable and often downright turbulent evolution of emissions trading in Europe. Not without reason, this process has been described in critical terms; but its perception as an outright failure, largely due to excess allocation in the first trading period and a resulting collapse in market prices for European allowances, does not capture the unprecedented nature of its achievement—creating the largest market for an environmental commodity in history within record time, including a system for monitoring, reporting, and verification, as well as trading floors and a link to the international system under the UN. Nor does it recognize the substantial lessons offered by its implementation and the efforts to follow up on such lessons by improving the system. With the following section, the political developments leading up to the adoption of the emissions trading directive are traced, followed by an attempt to clarify some of the misconceptions surrounding this instrument and its track record as a centerpiece of European climate policy. A glance at the future prospects of the European emissions trading scheme concludes this section.

Europe and Emissions Trading: From Opposition to Frontrunner

As shown in the preceding section, the market for emission allowances has become a central element—indeed, as one commentator has put it, the “crown jewel”[79]—of European efforts to mitigate greenhouse gas emissions from industry and the power sector. But emissions trading has by no means always been considered an instrument of choice in the European Union. In effect, Europe was strongly opposed to emissions trading during negotiations on the Kyoto Protocol. Against that backdrop, its emergence as the world’s largest market for greenhouse gas allowances less than a decade later is anything short of remarkable. But which were the factors ultimately prompting this shift in regulatory preference, described by commentators as an “extreme about-face” that occurred virtually “overnight”[80] and as an "an ultra-quick political 'pregnancy'"?[81]

Upon closer analysis, the process resulting in adoption of the European emissions trading scheme was determined by a number of independent factors, suggesting that environmental policy development is often guided more by political expedience and historical circumstances than by the rational criteria set out for policy choice in mainstream literature.[82] As mentioned above, Europe had formerly opposed the inclusion of international emissions trading in the global climate regime, largely out of fear that "trading might provide a cheap way for the U.S., Canada, Australia, and New Zealand to 'buy' themselves out of their obligations".[83] Notably, Europeans feared these states would avoid domestic efforts by acquiring excess emission rights—derisively coined "hot air"—that had been assigned to Russia and several eastern European states under the Kyoto Protocol. Only when this issue threatened to altogether derail the negotiations process, largely due to insistence by the United States, did Europeans reluctantly agree to include emissions trading as one of three flexible mechanisms in the Protocol.

As outlined earlier, the European Commission had instead been endorsing an internal combined energy and carbon tax for a number of years,[84] but had failed to secure the unanimity required in the Council for adoption of fiscal measures. Contrary to expectations, the revenue offered by such a tax did not offer a sufficient incentive for member states to facilitate its adoption. Even a toned-down version of the tax, which was limited to energy products and excluded carbon emissions, met with such resistance from industry and different member states that it was later abandoned. The directive on energy products taxation eventually adopted was so weak in scope that it could impossibly serve as a centerpiece of European climate policy.

Meanwhile, progress with the liberalization of gas and electricity markets was expected to lower energy prices, which some observers feared might lessen the incentive to explore costly alternative energy sources and more efficient energy use. Clearly, additional measures were needed to help achieve Europe's international climate commitments, but a general mistrust of market-based instruments in the environmental field continued to stifle real interest in their adoption. In an important shift, personnel changes at the European Commission and active involvement of foreign experts helped mobilize support for emissions trading in the late 1990s, in great part through more active application of the United States experiences with trading programs for conventional air pollutants.[85] Agreeing to include emissions trading as a flexible mechanism in the Kyoto Protocol in 1997 might have also altered the political and legal reality in a way favorable to supporters of this flexible mechanism.

Moreover, after the disappointing experience with energy taxation, emissions trading offered a particular attraction: it was evident that an allowance market would afford member states greater flexibility than a centrally determined tax regarding the allocation of reduction obligations to individual sectors and enterprises.[86] Unsurprisingly, this flexibility and the reliance on a market also increased the attraction of emissions trading vis-à-vis carbon and energy taxes for the private sector. In 1998 and 2000, two major oil companies—British Petroleum (BP) and Shell—decided to launch their own internal emissions trading schemes, signaling that trading markets could be feasible in large industrial sectors.[87] And finally, the permitting approach already evolving under legislation on integrated pollution prevention and control[88] was seen as a viable model for an emissions trading directive, notably its application to an enumerated list of activities and installations.[89]

Within the European Commission, this made it easier for the responsible environment division to convince its counterparts in the competition and enterprise divisions about the merits of a comprehensive greenhouse gas emissions trading scheme. And indeed, Environment Commissioner Ritt Bjerregaard made a strong statement in favor of emissions trading in June 1998 when she stated that "we have to get involved in emissions trading" and Europe "cannot let others dictate the rules."[90] Altogether, the European Commission played an unusually strong role in the debate, as is evidenced by the close similarity of the final trading scheme and the earliest design recommendations published by the Commission.[91]

All this clearly helped pave the way for relevant legislation, although an important catalyst for action arguably resulted from the decision of the United States to withdraw from the Kyoto Protocol in early 2001. With the largest potential buyer of international credits pulling out of the carbon market, compliance costs could be expected to remain significantly lower. At a symbolic level, moreover, emissions trading went from being perceived as an "illegitimate American attempt to shirk domestic responsibilities to a legitimate strategy to salvage the Kyoto Protocol without American participation."[92] Ultimately, these different influences converged, prompting a "historical path of choices [...] with a self-enforcing dynamic"[93] that has resulted in the largest market for an environmental commodity in the world. Given the challenges for member states regarding the adoption of rules, collection of relevant data, and definition of emission caps, the Union ultimately succeeded in introducing a trading scheme of unprecedented scale throughout Europe in a remarkably short timeframe.

Excess Allocation and the Market Crash

Although the European emissions trading scheme is nowadays largely credited with establishing an operational allowance market, its early years were fraught with a number of setbacks. During the first two trading periods, many central aspects of implementation in the trading scheme have been left to the individual member states, including the elaboration of National Allocation Plans (NAPs) determining the overall quantity and distribution of allowances to domestic sectors and individual operators.

Deciding on the number of allowances to be allocated—and the allocation method—has been aptly described by the Commission as "striking a balance between the theoretically desirable and the practically feasible,"[94] as it requires each member state to distribute its allowances according to a specified set of rules and principles, seeking a balance between the interests of various stakeholders while at the same time ensuring an adequate contribution to the national reduction commitments for greenhouse gases.[95] Defining the cap for the system as a whole and the sectors in particular is thus at the very core of the trading market, as it determines whether the scheme results in any substantial greenhouse gas reductions and thus fulfills its primary objective. But it is also a process fraught with technical difficulty and tough political choices, where "industry holds an information asymmetry over regulators," and member states can assert emissions projections "using opaque methodologies, designed to protect their industries."[96] As the actual allocation process in Europe eventually showed, these challenges have by no means been overstated.

For the first trading period, member states were required to draft and publish their National Allocation Plans by March 2004. Nonetheless, the contentious allocation process carried well over into 2005, and the final allocation plan was only approved on 20 June 2005.[97] Of the originally notified plans, fourteen out of twenty-five were only approved conditionally as a result of excess allocation.[98]

Eventually, the Commission approved the allocation of 6.57 billion allowances to more than 11,400 installations in the European Union for the initial three year period. Despite the foregoing delays, trading began as scheduled on 1 January 2005, and in its first year, the European carbon market already reached a trading volume of 362 million allowances and a market size of €7.2 billion.[99] By 2006, market activity had again reached record levels: 1 billion allowances were transacted worth €18.1 billion, representing a growth in volume of nearly 250 percent compared to the previous year.[100] By the compliance deadline of 30 April 2006, 8,980 installations had fulfilled their reporting obligations under the emissions trading directive, accounting for more than 99 percent of allowances allocated to installations in the twenty-one member states with functioning electronic registries at that point.[101]

In spring 2006, however, a dramatic development saw the price of allowances fall from originally more than €32 in the April spot market to a figure in the single digits some weeks later.[102] A first set of independently verified emissions reports for the year 2005 had been released by the member states, indicating that aggregate emissions in that year, at just over 2 billion tons, were significantly below the annual average allocation for the first period of close to 2.2 billion tons.[103] In no small part, this discrepancy was due to inventory data from several member states originally based on aggregate energy consumption statistics, rather than from specific information on each individual installation;[104] furthermore, instances occurred where the aggregated numbers did not match the sectoral coverage of the emissions trading sector, making it difficult to reconcile the numbers; and those states which had gathered information from operators were often unable to verify the data sufficiently in the face of severe time constraints. Also, many operators reacted to the imminent onset of the trading scheme with actual emission reductions, for instance in Germany with estimated reductions in the energy sector of roughly 10 million tons of CO_2 avoided in 2005. Although an intended effect of the trading scheme that, such early responses freed up additional supply. But clearly, much of the surplus in allowances was a result of overly generous allocation decisions of the member states. Such excess created a strong downward pressure on allowance prices, and the ensuing volatility was considered symptomatic of an immature market. More importantly, however, it also raised concerns about the environmental effectiveness of the trading scheme.

Attention therefore quickly shifted to the National Allocation Plans for the second trading period from 2008 to 2012, and to the need for sufficient scarcity of allowances in the market. 30 June 2006 marked the deadline for submission of these Allocation Plans. Unlike in the first trading period, verified sector- and installation-specific data was now available, providing a more reliable basis to predict the required level of the cap. An independent analysis of several draft plans released before the deadline had suggested that the second trading period would again suffer from the same shortcomings as the first, compromising the ability of the trading scheme "to deliver any net domestic emission reductions at all in its second phase" because of "very weak" national emission caps and "extremely generous" provisions on project credits acquired abroad from CDM and JI projects for compliance purposes.[105] Surprising some observers, however, the Commission reviewed the National Allocation Plans and responded in its allocation decisions by "making good" on its "promise to be tough." Accordingly, it demanded that a number of member states set much stricter caps on greenhouse gas emissions in the second period.[106]

Although several member states were again delayed in submitting their Allocation Plans, the Commission was able to publish a first set of decisions on 29 November 2006 regarding the National Allocation Plans of Germany, Greece, Ireland, Latvia, Lithuania, Luxembourg, Malta, Slovakia, Sweden, and the United Kingdom. Overall, the Commission called for an average cut in emissions of 7 percent compared to the draft plans submitted by these member states.[107] Several member states were required to reduce the number of allocated allowances by over 25 percent, in one case by even more than half.[108] According to the Commission, the main considerations guiding these decisions were consistency with the path toward achievement of the Kyoto commitments entered by each member state and consistency with emissions growth expectations and reduction potential.

As forward prices for the second trading period soon suggested, the strict position assumed by the Commission succeeded in creating the scarcity needed to elevate demand and restore some confidence in the European carbon market. While the price of allowances for the first trading period reached new lows as the end of that period approached, allowance prices for the second trading period rose steadily over the same period to reach a price of over €18 per ton by the end of 2006.[109] At the time of writing this essay, the price for December 2008 allowances remained comfortably above €20.[110]

Favoring Incumbents: The Challenge of Windfall Profits

Another major shortcoming of the emissions trading scheme during its initial trading phases has been less amenable to a quick remedy, and that is the issue of "windfall profits." In this context, windfall profits denote the increase in electricity prices and consequently in corporate profits resulting from the free allocation of allowances, when opportunity costs of allowances are passed through to consumers despite the fact that the allowances were obtained free of charge.[111]

Common allocation methods are grandfathering, benchmarking, and auctioning, all of which have also been applied by the member states implementing the European trading scheme. Allocation via grandfathering typically involves the free distribution of allowances based on historic emissions. One main disadvantage of grandfathering is that it may penalize early action, as emissions-intensive installations receive more allowances. Allocation through benchmarking, in turn, is based on a technical benchmark, such as average emissions per unit of output or input. While this method has the advantage of rewarding early action and low emissions intensity, it generally requires large amounts of data and incurs considerable administrative cost. Furthermore, it is considered difficult in application to certain sectors, such as the steel sector, due to considerable differences in the form of production and the types of output. Finally, auctioning is comparably simple and requires market participants to purchase their allowances at the auctioning price. This method also rewards early action and is relatively straightforward to administer. Moreover, the proceeds from selling allowances can be a distributional tool to generate income from emitters (who pollute a public good) to provide public benefit.[112]

As stated above, the occurrence of windfall profits in Europe was strongly dependent on the allocation method. Generally, costs can only be passed through in the absence of competition; because the European electricity market is not exposed to competition from outside the trading regime, it was able to generate substantial windfall profits. These have been strongly criticized in the media and in civil society due to the unjustified burden they create for customers, and due to the fact that—predominantly in systems where allocation was based on historic emissions rather than benchmarks—they ultimately strengthened incumbent energy providers using fossil fuels, whereas providers of renewable energy received no allowances due to the greenhouse gas neutrality of their activities. Given the difficulties to access grids and customers, access to markets for renewable technologies is already difficult enough,[113] making this additional obstacle particularly problematic.

Still, the only perceived remedy—government auctioning of allowances instead of free allocation—was almost entirely precluded in the two initial trading periods by a clause in the emissions trading directive limiting auctioning to 5 percent of allowances in the first trading period, and 10 percent in the second. By including these limits, the Commission sought to prevent serious distortions of competition in the internal market, a consequence it feared if member states opted for widely divergent allocation methods; at the same time, however, a mandatory percentage of auctioning had no support in the Council at the time and would have incurred ample stakeholder resistance.[114]

Evidencing this lack of support, few member states chose to take advantage of even the very limited share of auctioning permissible under the directive. Only four member states used auctioning during the first phase, with auctioned allowances accounting for a negligible 0.13 percent of total allowances allocated in Europe; more allowances are being auctioned in the second phase, although the quantity is again well below the specified limit.[115]

Some member states have decided to assign the main share of auctioning to the electricity sector, where the windfall profits occurred. Despite the limits specified in the directive, thus, electricity producers in Europe might have to carry the main burden of auctioning, preventing them from generating windfall profits as substantial as those seen during the first trading period.

Reforming the Emissions Trading Scheme: The Way Forward

As the following section will show, the Commission has drawn a number of lessons from the first trading period, which, at any rate, had always been intended as a “learning phase.”[116] In particular, the Commission reduced fifteen Allocation Plans for the first trading phase by an aggregate 290 million tons of CO_2, and twenty-three Allocation Plans for the second trading phase by 242 million tons per year or an aggregate of approximately 1.2 billion tons for the five-year period. But some of the shortcomings identified to date could not be addressed within the existing regulatory framework. For instance, European rules imposed limitations on the percentage of allowances that may be auctioned in the first and second trading period. Furthermore, after initial experiences had been made with the EU ETS, the discussion about extending the coverage of the markets and the number of greenhouse gases included in the trading scheme gained renewed dynamic.

Against this backdrop, and pursuant to a mandate contained in the original Emissions Trading Directive, the European Commission has been engaged in a review of the emissions trading scheme, a process involving an assessment of its functioning and scope. In November 2006, the European Commission issued a report with a preliminary review of the trading scheme, finding that the certainty and predictability of the program needed to be improved, and setting the terms of reference for a more comprehensive review of current shortcomings and opportunities for expansion of the scheme to other sectors and gases.[117] Based on this review, the Commission released a comprehensive legislative proposal in early 2008 which would fundamentally amend the current legislative basis of the emissions trading scheme.[118]

Substantively, this proposal expands the scope of the emissions trading scheme and centralizes much of its management with the Commission. If adopted as drafted, the proposed amendments would cap greenhouse gas emissions of covered sectors at the European level, rather than through the current system of National Allocation Plans developed by each individual member state. By setting an annual cap in line with the reductions needed to meet the independent commitment of a 20 percent reduction by 2020, the Commission would be in a position to avert excess allocation, one of the main shortcomings witnessed during the first trading period. Also, such centralized allocation would eliminate the partially significant divergences between National Allocation Plans affecting the two initial trading periods.

Moreover, the Commission proposal would initially require two-thirds of the total quantity of allowances to be auctioned, with full auctioning in the power sector and progressive phasing-out of free allocations in all other sectors by 2020. If an international agreement to replace the Kyoto Protocol is not reached, a higher proportion of allowances would be given out for free to sectors which risk suffering from distortions in global competition arising from carbon caps in Europe and not elsewhere. Additionally, importers of energy-intensive products from countries with less stringent climate policies may be included in the emissions trading scheme to prevent relocation of European industries, also referred to as "leakage."[119] The amendment proposal would introduce unlimited banking of allowances from the second trading period into the third trading period, reducing the likelihood of extreme volatility as witnessed during the first phase.

As for the scope of the trading scheme, the proposed changes would expand its coverage to new sectors, such as petrochemicals, ammonia, and aluminum production, and to new gases, specifically nitrous oxide (N_2O) and perfluorocarbons, while excluding smaller installations where the administrative efforts of participation outweigh the environmental benefit. Likewise, the voluntary capture of CO_2 and its storage in geological formations—referred to as carbon capture and storage (CCS)—would be included in the trading scheme, with the result that emissions captured in accordance with requirements set out in a separate proposal would not be counted against the compliance burden of that operator.[120] As part of a separate legislative initiative, moreover, aviation—which has been largely unregulated as regards its climate impacts—could be covered by the European emissions trading scheme through a cap on CO_2 emissions from all planes arriving at or departing from European Union airports starting in 2012.

Amended rules on the inclusion of credits obtained through JI and CDM projects would restrict their use beyond 2012 and reflect the continued reservations of the European Commission when it comes to reliance on foreign reduction projects for domestic compliance, a position that can be partly explained with the very contentious debate on the environmental stringency and distributive fairness of the CDM. Indeed, recent studies suggest that most projects launched through this mechanism would have occurred anyway without project funding, and that approval procedures are heavily biased in line with the composition of the deciding Executive Board.[121]

On 3 March 2008, the Council of Environment Ministers adopted conclusions on the Commission proposal for a revised emissions trading scheme, welcoming it overall and giving wide support to its targets and principles.[122] Still, individual member states voiced concern about the effects of the revised trading scheme on the competitiveness of their domestic industries and the possibility that affected operators may be prompted to relocate overseas; Germany, in particular, has lately become critical of the proposal as its domestic elections approach, with Chancellor Angela Merkel voicing concern about the increased share of auctioning and warning against an "unwise" approach to European climate policy.[123] One of the demands in this regard is consideration of trade-restrictive border adjustments for energy-intensive products at an earlier date than currently foreseen in the proposal. Restrictions on the use of JI and CDM project credits have also prompted debate on whether these were too narrow. Meanwhile, finance ministers debating the proposal in the Council for Economic and Financial Affairs unanimously opposed earmarking part of the revenues from auctioning.

A draft compromise released on 24 September 2008 by the rapporteur in the European Parliament backs the overall direction of the proposal, but suggests a number of amendments on specific issues. Most notably, the compromise calls for all auctioning revenues to be used toward financing a list of specified climate measures, and introduces additional requirements for the eligibility of project credits, making their use conditional on whether they are "high quality" credits that "incentivise international agreement and the linking of trading systems."[124] Additional changes relate to the auctioning modalities and leakage, many of which are in line with the demands from member states and industry. Following a heated debate in the Committee on the Environment, Public Health, and Food Safety, these recommendations were adopted largely unchanged on 7 October 2008.

Initial shortcomings, such as excess allocation, high volatility, and windfall profits, have been addressed in principle with the proposal for a fundamental reform of the trading scheme beyond 2012. But it remains to be seen whether the suggested changes are sufficient to avoid similar shortcomings as those experienced during the first and second phases. Some aspects could have arguably been further improved, such as, for instance, the share of auctioning: for various reasons, member states and the European Commission have still been reluctant to embrace 100 percent auctioning from the outset of the third trading phase, falling short of schemes currently being elaborated or implemented in the United States.[125]

Ultimately, however, this also underscores the perhaps most important lesson learned with the European emissions trading scheme: while launching an initiative of this scale cannot be expected to be perfect from the outset, it may nevertheless be the first necessary step in any such an endeavor; subsequent amendments and fine-tuning may then help address the lessons learned in the earlier phases. As it is, Europe will have been engaged in large-scale carbon trading nearly half a decade before many other industrialized nations, including the United States, and given the global rise of carbon trading as a policy instrument, this experience is most likely going to prove of great value to both decision-makers and participants in the trading scheme.

ACHIEVING ENERGY SUSTAINABILITY: A LARGELY UNFULFILLED POTENTIAL

Energy is key to achieving sustainable economic growth and averting dangerous anthropogenic climate change. A recent study forecast that renewable energy could deliver half of global primary energy needs by 2050 with available technologies and an appropriate policy framework.[126] Meanwhile, a growing body of research suggests that improved energy efficiency offers the largest potential for significant emissions reductions at negative or no cost.[127] As outlined above, the European Union has sought to leverage this potential by adopting a range of measures targeting energy supply and demand, many of which have fairly successful track records. But overall, and especially with a view to energy efficiency, the measures taken did not yet deliver results to the extent possible. Regarding both renewable energy promotion and energy efficiency, the measures and their implementation by the member states have failed to mobilize the full potential. Meanwhile, new measures proposed to address these shortcomings and move closer toward European energy sustainability have sparked political controversy and face serious challenges in the legislative process. Central features of this debate are outlined below.

Toward a Sustainable Energy Supply: Promoting Renewables

Globally, renewable energy has undergone unprecedented growth in recent years, with investment in new renewable capacities expanding at phenomenal rates every year. Much of this growth has occurred in Europe, where conventional and offshore wind power, grid-connected and off-grid solar photovoltaic power, solar thermal power, and biomass contribute a significant share to the overall energy consumption in many member states.[128] Overall, the promotion of renewable energy has certainly been embraced as a central strategy element in the European Union, where renewable sources are being deployed in three important sectors: power generation, space heating and cooling, and transport fuels.[129] But current initiatives to further expand the contribution of renewable energy to the overall energy supply face a number of significant political and environmental challenges.

Legislation currently in place has focused on promoting electricity produced from renewable energy sources as well as biofuels or other renewable fuels used for transport. While not entirely ineffective, both measures have failed to achieve the indicative objectives they define. For instance, electricity produced from renewable energy sources is set to contribute 21 percent to total electricity consumption in the European Union by 2010, yet the Commission only expects a share of 19 percent to be feasible with current policies and measures. Likewise, an interim target of 2 percent for the share of biofuels in transport diesel and petrol in 2005 has already been missed, while the indicative target of 5.75 percent for biofuel deployment by 2010 will likely be missed by one percentage point.[130] And even these projections might be overly optimistic: according to recent data, biofuels effectively contributed only 1 percent of transport fuel in 2005.[131]

If one can judge by official statements from the European Union and the member states, these shortcomings are not due to lacking awareness about the urgency and benefits of renewable energy promotion. Recently, for instance, the European Commission again acknowledged that “the renewable energy sector stands out for its ability to reduce greenhouse gas emissions and pollution, exploit local and decentralised energy sources, and stimulate world-class high-tech industries.” But until recently, member states still lacked the political will to embrace binding—rather than indicative—targets at the European level. With the adoption of an integrated climate and energy policy in early 2007, however, this attitude may have seen an important shift as the European Council agreed to a binding 20 percent share of renewable energy sources in energy consumption and a binding 10 percent minimum target for biofuels in transport. In January 2008, the Commission put forward a proposal for a new directive on renewable energy sources, fleshing out these overall targets and specifying binding national targets for each individual member state based on past progress and economic performance.[132]

While the willingness to agree on binding targets clearly promises more serious efforts on the part of member states, a number of questions are likely to affect the political debate as this proposal moves forward in the legislative process. In particular, controversies emerged over the national targets, with several member states claiming that those objectives are unrealistically high or fail to consider past achievements in the area of renewables. Also, the national targets are no longer limited to electricity generation, but extend to all forms of energy. Member states will thus be called upon to assign the required efforts to different sectors, bringing about additional challenges.

A central aspect of the proposal, the creation of a system of tradable guarantees of origin, has already been criticized by several countries—including a coalition of Germany, Slovenia, and Spain[133]—who favor support schemes based on feed-in tariffs, perceived by many as more effective and efficient in promoting renewable energy than quantity-based systems. While a harmonized system for the transfer of such guarantees does not preclude implementation of feed-in tariff schemes in individual member states, it is unclear how these two fundamentally different approaches would coexist in the European Union. Moreover, the greater flexibility and cost efficiency offered by a system of tradable guarantees of origin would be partly offset by the considerable technical and administrative challenges such a system would raise. Given that a number of member states in the European Union have adopted promotion schemes based on feed-in tariffs, it is difficult to predict the outcome of the debate at this point.

Much debate has also centered on the 10 percent target for the market share of biofuels in the transport sector. Originally, the idea of including biofuel in the climate strategy was based on the fact that nearly one-tenth of agricultural land in Europe had been taken out of use to reduce excess production of food, and the agricultural sector was pressing to find new ways to use this set-aside land.[134] Because of perceived environmental and development risks, however, biofuels have since prompted highly critical responses from social and environmental groups, based on studies suggesting that biofuel production is costly, has a limited impact on reducing greenhouse gases or improving energy security, and has a significant impact on world crop prices.[135]

A main concern is that a large percentage of biofuels will be imported from third countries in the developing world, where the agricultural sector will be deprived of the arable land it needs to meet rising food demand, and that biofuel production will increase pressure on already endangered rainforests and other biodiversity habitats, as has been observed, for instance, in Indonesia and Malaysia. Partly in response to these concerns, the proposal introduces sustainability criteria for biofuels, requiring that production and use of eligible biofuels achieve net life-cycle greenhouse gas emission savings of at least 35 percent over conventional fuels. Likewise, land with high biological diversity or carbon stock, such as natural forests, protected areas, grasslands, and wetlands may not be used to produce biomass for biofuels. But these criteria are still not considered ambitious enough by environmental groups and certain member states, and may be unable to prevent further food price increases and outright fraud. Calls to reconsider the mandatory share and relax the timeline might help allow for further development of new, more sustainable second generation biofuels and also give the least developed countries an opportunity to foster a sustainable biofuel industry.

On 11 September 2008, the Committee on Industry, Research, and Energy of the European Parliament—which had been heavily lobbied by various interest groups—voted on a series of compromise amendments to the original proposal of the European Commission. Included in the amendments is the definition of mandatory interim targets for renewable energy deployment in the member states, and a comprehensive revision of the biofuel target for transport fuel: a significant share—40 percent—of the renewable energy contribution in the transport sector should now come from sources other than biofuels, such as electricity and hydrogen. Likewise, the sustainability criteria have been strengthened from 35 percent to 45 percent savings initially, and then even to 60 percent from 2015. It remains to be seen whether these amendments can also pass the upcoming plenary vote, and whether the Council will then choose to adopt them or instead issue a Common Position for a second reading, possibly even necessitating a conciliation procedure.

Managing Energy Demand: Harnessing Energy Efficiency

According to a recent study focused on energy productivity potential in Europe, as much as twice the amount of electricity consumed by the entire European Union in 2003 could be saved by 2020 using existing energy efficient technologies.[136] Such potential has understandably garnered attention at the decision-making level, and indeed, some of the earliest Community measures on climate and energy were focused on energy efficiency, such as the original SAVE Program of 1991.[137] On a broader level, the European Commission recommended including energy savings as an important element in its “Lisbon Strategy” to boost competitiveness and employment throughout Europe, resulting in a 2005 Green Paper which stated that the European Union could save at least 20 percent of its energy consumption by 2020, or the equivalent of €60 billion a year. In the process, the Commission argued, Europe would reduce its dependence on oil and gas imports and harness the quickest and most cost-effective approach to greenhouse gas reductions for compliance with international climate commitments.[138]

Still, energy efficiency has remained something of a neglected poster child in Europe, with member states supportive of legislation in principle, yet at the same time concerned about the potential social and economic consequences of any proposal.[139] Likewise, they have been late or less than ambitious when submitting National Energy Efficiency Action Plans as required under the energy end-use efficiency and energy services directive: only two plans had been notified before the relevant deadline, with the plans finally submitted mostly presenting “a business-as-usual approach, not a staking out of forward looking and visionary strategies”; even the Commission has been forced to conclude that this reflects a “considerable gap in several member states between the political commitment to energy efficiency, on the one hand, and the measures adopted or planned [...] and the resources allocated to preparing it, on the other.”[140]

A recent report suggests member states are lagging in the arguably most important sector, improved energy efficiency in buildings,[141] while poor enforcement of energy standards and labeling requirements for products have even prompted industry to complain because of the ensuing benefits for lawbreakers and the detrimental effect on competition.[142] Indeed, there is a perception that a “myriad of information barriers, market imperfections and policy distortions” are currently preventing investments in greater energy productivity within the European Union, while a “range of policies dampen price signals and reduce incentives for end users to adopt energy productivity improvements, including widespread energy subsidies to state-owned enterprises and subsidies on fuel for consumers in some countries."[143]

Current legislation on the energy efficiency of products, buildings, and services is thus not harnessing market forces in ways that allow capturing the full potential for greater energy efficiency. And despite the economic benefits it offers, such as reduced energy costs, improved energy efficiency appears particularly difficult to regulate: as a recent study suggests, investment in energy efficiency only tends to occur if significant upfront benefits outweigh initial cost.[144] As outlined earlier, the European Union has embarked on an ambitious agenda with its integrated climate and energy policy launched at the beginning of 2007. But unlike the area of energy supply, where a legally binding target for renewable energy use of 20 percent by 2020 was proposed, the same policy package only sets an "indicative" target of 20 percent greater energy efficiency by 2020. And as mentioned earlier, legislation already in force, such as the energy services and end use directive, also limits itself to setting out indicative targets. Ultimately, one can only conclude that a clear dichotomy remains between the potential of energy efficiency identified for Europe and the political will of European states to harness it facing the difficulties to find or implement effective policies.

Still, there may be a new dynamic emerging in this area. After a high-level stakeholder advisory group set up to advise the European Union on competitiveness, energy, and the environment recommended addressing energy efficiency with a "new sense of urgency"[145] and the European Parliament called for a "market transformation" in energy-using products and an "energy efficiency revolution,"[146] the Commission followed up on its Green Paper with a detailed Action Plan on Energy Efficiency setting out over seventy-five measures in ten priority areas to be implemented over the course of the next half decade.[147]

As a result, the Commission is expected to make several new proposals on energy savings—from office and street lighting, incandescent lamps and lighting in private households, and passive heating and cooling in buildings—as well as on an international energy efficiency agreement and on a revision of the energy labeling directive. In 2007, moreover, the Commission announced a Strategic Energy Technology Plan setting out a new energy research agenda geared toward more joint planning, strengthened industrial research and innovation, and the creation of a European Energy Research Alliance.[148] While the political track record in this all-important issue has been less than overwhelming, these initiatives give reason to hope that European decision-makers are finally embarking on a pathway to harness the enormous potential for improved energy management throughout the region. Record oil prices and growing concern about energy dependence from Russia, where repeated strong-arm tactics by the state-controlled monopolist Gazprom have severely undermined market confidence, could help sustain this momentum.

SUSTAINING EUROPEAN LEADERSHIP: THE IMPORTANCE OF TARGETS

Under its establishing treaty, the European Community aims at "promoting measures at international level to deal with regional or worldwide environmental problems," to which end it may "cooperate with third countries and with the competent international organisations" by concluding international agreements. Externally, the Community exercises this mandate pursuant to the doctrines of attributed powers and parallelism between internal and external competences.[149] Given the shared power to adopt climate and energy policies, both the European Community and its member states are thus fully entitled to negotiate and act under an international agreement on climate change.[150]

Europe has made active use of this competence, and observers have variously described it as an "international agenda setter"[151] and "without doubt, the main—in fact, the only major—driver behind the push for post-2012 commitments, whether in the form of new commitments within the Kyoto Protocol framework or a new instrument".[152] Claims of leadership are often backed with reference to the negotiating history and subsequent entry into force of the UNFCCC and the Kyoto Protocol, where commentators go so far as to suggest that "had it not been for the European Union, the Kyoto Protocol might have been dead".[153]

Undeniably, the European Union has assumed a position of leadership in the international efforts to mitigate climate change. But such a role does not come without substantial political investment. In an increasingly globalized economy, moreover, it has not always been met with enthusiasm by the private sector, which has often voiced concern over the potential impacts on market opportunities and competitiveness. All this raises a number of questions: what interests and circumstances have motivated European leadership on climate change, and how has it manifested itself on the diplomatic arena? More importantly, can Europe sustain this leadership in times of economic turmoil and more diverse membership than ever before? Drawing on recent literature, the following sections will review some of the main arguments brought forward in this debate and assess their continued relevance; given their importance as a standard of reference, the focus will be placed on greenhouse gas mitigation targets.

Explaining European Leadership: Why Europe Has Embraced the Climate Agenda

Much analysis has been devoted to the motivations behind European climate leadership, and various explanations have been suggested at different points in time. Mostly, these relate to the raison d'être of the European Union as an institution, the scope of its powers and activities, and its role in the international political arena. Domestically, for instance, attention has been drawn to the fact that climate change is one of the few policy issues around which Europeans have been largely united over a number of years. Surveys of public opinion consistently show that two thirds or more of European citizens consider climate change one of the most serious problems facing humanity.[154] Unsurprisingly, related policies are therefore seen as "a good political 'spin'," evidencing the capacity of the Community "to deliver effective policies to address the public's concerns in an area where citizens believe the Union can—and should—play a strong role."[155]

Additional momentum has arguably resulted from the growing concern over energy security in the face of rising oil and gas prices a trend which only recently reversed, as well as rising dependence on oil imports from politically unstable regions.[156] Following several setbacks in the European integration process, notably the rejection of a European Constitution in 2005 and the failure to secure public support for the Lisbon Treaty in 2008, climate and energy policies are seen as a unifying and sufficiently urgent agenda for the European Union. Internationally, moreover, the high profile of climate negotiations has been described as a useful vehicle to promote the multilateral and rule-based approach to global governance espoused by the European Union, thereby enhancing its role as a global actor and its ability to build coalitions.[157]

But just as such very concrete circumstances and objectives may explain the European motivation to seek a position of leadership in climate negotiations, more abstract considerations, such as institutional structures and dynamics, have been cited as a vital precondition. In particular, scholars have argued that the design of European multi-level governance creates numerous leadership points where competitive leadership has been initiated, opening avenues by which advocates of climate change action have been able to inject their priorities and concerns into the policy debate. But they also highlight an active network of environmental citizen groups and internal division among the traditional opponents of stringent climate policies, industry and commerce, and see them as fostering a unique and fertile political landscape.[158]

By way of conclusion, thus, a number of factors motivating European action on climate change have been fairly universal, and should therefore apply equally to other states and regions. Such factors not only include public concern about climate change impacts, the split within traditional stakeholders from industry and commerce and the perceived need for appropriate mitigation and adaptation strategies, but also the desire to reduce dependency on energy imports and thereby increase energy security. Other circumstances are more specific to the European Union, however, such as its institutional dynamics and the use of climate policy to advance an international agenda.

European Leadership in Action: Promoting Mitigation through Quantified Targets

In an attempt to conceptualize the European stance on climate policy and energy sustainability, its leadership has been described as structural, instrumental, and directional in nature.[159] As a structural leader, Europe has drawn on the weight afforded by its membership, combined population, and economic power to promote dynamic international cooperation. As an instrumental leader, in turn, it has used its negotiation skills and credibility—with varying levels of success—to accommodate different priorities and build coalitions around mutually beneficial solutions. Arguably the most important dimension of European leadership, however, is the directional example it can provide by successfully adopting commitments at the national and international level and implementing domestic policies and measures; worldwide, Europe is perceived as a climate leader for demonstrating that absolute mitigation commitments and policy innovation are achievable without compromising economic growth. In doing so, the European Union has changed the perceptions of other nations and evidenced its willingness and ability to deal with the climate challenge and greenhouse gas mitigation; this has simultaneously bolstered its symbolic power and legitimacy.

Such directional leadership, which is primarily based on leadership by example and operates through the soft channels of diplomacy, persuasion, and argumentation, has been particularly evident in the European campaign for ambitious greenhouse gas reduction targets at the international stage.[160] Quantified and binding targets have been a defining element of the European climate strategy: internally, they have created an essential framework for action by affording legal certainty and thus an incentive for longer-term planning and investment. Surveys among industry representatives, for instance, have shown that 73 percent of operators covered by the EU ETS were influenced by carbon prices when planning their investments.[161] Perhaps more importantly, however, ambitious targets have also been a visible measure of European leadership abroad, and are consciously harnessed as "a symbol of Europe's determination."[162]

Looking back, Europe has been a consistent advocate for stringent mitigation efforts on the international plane. As mentioned above, already in 1996, the Council declared that "global average temperatures should not exceed 2°C above pre-industrial levels."[163] In the months leading up to the Kyoto Protocol negotiations, moreover, Europe set the tone and became a norm entrepreneur by proposing that industrialized nations commit to reducing their greenhouse gas emissions by 15 percent of 1990 levels by 2010; and while this initiative did not find its reflection in the mitigation commitments ultimately agreed on, it forced other countries into a defensive position and prompted them "to go farther than they had said they were willing or able to go."[164] Looking at the absolute reduction targets, Europe adopted the most ambitious obligation among major industrialized nations, binding itself to an average greenhouse gas reduction of 8 percent by 2012 relative to 1990 levels.

Ever since, the Community and its member states have placed a focus on "medium and longer term emission reduction strategies, including binding targets" as central factors in the achievement of the strategic objective of limiting global warming.[165] Following a number of programs and initiatives, the Commission most recently operationalized this objective in January 2007 with an outline of "options for realistic and effective measures" to meet the 2°C objective.[166] Among the main elements identified by the Commission was the need to make ambitious mitigation commitments an "overarching international priority" in the negotiations on a future international climate regime.[167] In October 2008, this need was reaffirmed by the Council when environment ministers agreed that a future climate regime should aim at a "reduction in global emissions of at least 50% from 1990 levels by 2050," to which developed countries should contribute by lowering their greenhouse gas emissions by "between 25 and 40% by 2020" and "80 to 95 % by 2050 compared to 1990 levels."[168]

Going beyond a mere discussion of such commitments and the abstract need thereof, the Council also proceeded to confirm the greenhouse gas reduction targets for the European Union by making a "firm independent commitment" to achieve a 20 percent reduction of greenhouse gas emissions by 2020 compared to 1990. Moreover, it endorsed an objective of a 30 percent reduction "provided other developed countries commit themselves to comparable emission reductions while economically more advanced developing countries contribute adequately according to their responsibilities and respective capabilities."[169] If stringent mitigation targets are an indicator of directional climate leadership, Europe would thus appear on course to remain an international leader.

Looking at Emissions Pathways: From Rhetoric to Reality?

As stated earlier, however, the ability of Europe to lead by the power of example is strongly dependent on the scope and success of its domestic policies, which have been described as "the basis and justification for its external approach."[170] Accordingly, international leadership will strongly depend on whether Europe succeeds in achieving the obligations it entered under the Kyoto Protocol and, moving forward, whether it remains on path to achieving its recently adopted 20 percent targets. Evidently, a failure to meet the commitments entered under the Kyoto Protocol and the subsequent targets adopted by the Council would strongly undermine European credibility. By the same token, however, success in meeting these objectives would amount to a moral victory and solidify the perception of Europe as a leader. In the recent past, European climate policy has been described as "less solid than its rather glamorous packaging suggests,"[171] "active," but "not … overly ambitious."[172] As has been aptly noted, observers would likely charge that "while Europe is good at setting lofty goals, it is poor at actually implementing them."[173] Inevitably, the question therefore must be: how successful has the European Union actually been in recent years at reducing greenhouse gas emissions?

Following the European ratification of the Kyoto Protocol in 2002, European emissions trends were not, initially, on course to meet the commitments set out therein; By 2005, the statistical agency Eurostat reported that "both greenhouse gas emissions and energy consumption have increased since 2000" and several member states "are moving away from their agreed targets."[174] The resulting credibility gap between international promises and domestic implementation has been described as "the Achilles' heel of EU international leadership."[175]

More recently, however, increased efforts at the policy level, coupled with rising fuel prices and mild winters, have helped reverse this trend. Emissions projections released in October 2008 have confirmed an overall trend of decreasing greenhouse gas emissions, with the European Union on track to meeting their joint Kyoto Protocol commitments "by a large margin" despite significant disparities in individual member state performances.[176] However, these projections already factor in further implementation of additional policies and the use of carbon offsetting mechanisms. Obviously, then, adoption of the comprehensive legislation proposed in early 2008 would be of great importance for continued international leadership, setting Europe on a path for medium- and long-term evolution of its climate policies.[177]

At the time of writing, in November 2008, negotiations in the Council and European Parliament were at a critical stage, with the current French Presidency of the European Union under pressure to conclude a political deal by the end of this year before the end of the UN climate negotiations in Poznan and ultimately before the Parliament goes into election campaign mode in May 2009. Faced with a global financial crisis and economic downturn, however, European heads of state and government meeting in October revealed very different views on the commitment levels they are willing to embrace making it very difficult to identify a compromise acceptable for all sides.

While the European Council ultimately confirmed "its determination to honour the ambitious commitments on climate and energy policy which it approved in March 2007 and March 2008,"[178] growing concern over their impacts on industrial competitiveness had previously incited a draft resolution by the French Presidency affording special treatment to certain countries and industry sectors, and rejecting the automatic increase of the global reduction target to 30 percent if other countries engage in comparable efforts.[179] Moreover, although the Council ruled out delaying the adoption of a package of legislative proposals on climate and energy and confirmed its intention to observe a December deadline, this was only possible after a group of member states led by Poland received assurances that the final legislative proposals would reflect differences in "economic potential" at a time of "serious financial difficulty."[180] placing the burden on the French presidency to find common ground.

This important summit evidenced that the political dynamic among member states is becoming more difficult, both as a result of current economic trends and, more fundamentally, far greater diversity within an enlarged Europe. It is unlikely that these difficulties will subside in the near future. Not only is there a lot of talk about economic recession, but in the past, leadership has been strongly linked to the member state holding the Presidency of the Council, and from January 2009, this function will be exercised by the Czech Republic, whose President Václav Klaus has repeatedly disagreed with members of his cabinet and likened the debate on climate change to alarmism and a "fatal conceit."[181] Similarly, internal tensions between the institutions of the European Union, for instance between the Commissioner for Environment, Stavros Dimas, and the Commissioner for Enterprise and Industry, Günter Verheugen, have lately affected the political discussion and are likely to resurface in the context of arguments on competitiveness of European industry under ambitious climate leadership.

In many ways, the test of European leadership is just beginning. "Passive" emission reductions through the collapse of the eastern European economy and the transition from coal to natural gas in the United Kingdom—both of which greatly facilitated the formation of the current burden sharing agreement[182]—were unique developments that are unlikely to recur. As one group of authors aptly described it, in "an atmosphere of economic competitiveness and development concerns, the message that emissions must be driven ever downward over the coming decades will be difficult to bring across—not just externally, but within the Union itself."[183]

Section 5: Conclusions

On the European policy agenda, climate change and energy have advanced from largely peripheral and separate issue areas little more than a decade ago to an integrated priority of the Community. As one author aptly described it, "[c]limate change has become the main driver of EU energy policy, and EU energy policy holds the key to meeting the climate policy objectives."[184] Due to a unique convergence of driving forces at the systemic, societal, and governmental level,[185] Europe made the momentous decision to afford these twin challenges a central position in the domestic political process. But also internationally, global warming and energy sustainability have arguably not only become much more prominent within the international policy debate, as can be seen by recent media coverage and the agendas of countless international meetings and conferences, such as the summits of the Group of Eight Industrialized Nations (G8), but also two of the most defining themes of European foreign policy, promoting Europe to a leadership position as a norm entrepreneur and agenda setter.

While tracing the development and underlying drivers of the European response to climate change, this essay has also identified a number of shortcomings and disparities between the rhetoric and the often challenging realities of implementation. But both the successful and also the less successful chapters in the European experience have yielded a number of useful lessons that may also inform the transatlantic debate and provide insights for other countries and regions engaged in similar efforts.

Clearly, one of the most visible aspects of the European strategy against climate change has been the emission limitation and reduction targets agreed under the Kyoto Protocol and for the period beyond 2012. The commitment to these absolute reduction targets provides the necessary certainty for urgently needed investments in more efficient and less greenhouse gas intensive technologies, while also creating a favorable environment for the transition of alternative processes from the experimental stage to the market.[186]

A good illustration of the importance of binding targets is the disappointing track record of measures geared toward the promotion of energy efficiency improvements and increased deployment of renewable energy sources at the European level; in both cases, the adoption of mere indicative targets did not create sufficient pressure for robust action. Also, voluntary targets agreed on with industry representatives have not elicited the intended response. By proposing binding targets not only for emissions reductions, but also for renewable energy and, albeit of an aspirational nature, for energy savings, the Commission has evidenced its intention to address this shortcoming.

Emissions trading has been another source for lessons. For one, it has shown how the definition of the cap—also a form of target—is contingent upon the availability of accurate emissions data and subject to political deliberation within the member states. During the initial trading period, these factors resulted in excessive allocation at the level of most member states, prompting a collapse in allowance prices and high market volatility. Also, political pressures necessitated the inclusion of allocation free of cost as the main allocation method, incurring unprecedented windfall profits for incumbent utilities in the energy sector. Here, again, the proposals for a review of the trading scheme—with centralized allocation decisions and 100 percent auctioning for the energy sector as well as increasing auctioning over time for industry—illustrate the willingness to learn from past mistakes. And at this point, it bears mentioning that placing an emissions trading scheme with an ambitious cap at the center of a mitigation strategy results in a situation where the private sector—not the public—is accountable for the fulfillment of its commitments, with failure to comply subject to fines. Ultimately, this results in a unique phenomenon in environmental policy and regulation, where the burden to fulfill the targets set by policies lies—at least as far as the cap goes—on the private sector and where the threat of tangible sanctions renders it highly unlikely that the emissions reductions required by the cap will be altogether missed in the participating sectors.

Overall, these developments suggest a general tendency of the European Union to embrace market-based instruments, an attitude that would have been difficult to imagine only a few decades ago, when Community environmental policy was dominated by traditional command-and-control regulation. In some cases, this readiness to take bold steps has resulted in a somewhat embarrassing need to revisit policy objectives already agreed on, such as the mandatory target for biofuels.

And yet, the mere consideration of quantified targets for renewable energy, energy efficiency, and emission reductions beyond 2012 has sent a strong signal about mitigation efforts to the international community, while the European emissions trading scheme has moved beyond its admittedly difficult beginning to become a central driver in the global carbon market. An important aspect throughout has been the systematic use of policy learning processes through inbuilt review and evaluation mechanisms in all central measures. Not only has this facilitated an improvement of the affected initiatives, but it has also afforded learning experiences from the different approaches applied in different member states.

With a wide variety of measures already adopted or proposed at the European level,[187] as well as considerable differences in implementation at the member state level, where divergent legal traditions and institutional structures further exacerbate regulatory diversity, it is a challenge to arrive at a consistent and effective instrument mix. With emissions trading in place, for example, other measures applied to the affected sectors—such as promotion schemes for renewable energy or energy efficiency—need to be carefully designed to prevent substantive conflicts or counteracting objectives and regulatory approaches; mandated energy savings in a covered installation, for instance, free up allowances that will be sold and merely shift the greenhouse gas emissions elsewhere.[188] On the other hand, a well-designed instrument mix can yield multiple synergies; for instance, if energy efficiency measures are successful and reduce primary energy demand, the achievement of other objectives, such as renewable energy targets, might become easier.[189] Accordingly, once a certain degree of proliferation and regulatory differentiation has occurred, attention has to also be increasingly devoted to the interactions of different instruments.

At this decisive point in history, with the worst economic and financial crisis in more than a generation and the deadline for agreement on an international climate regime beyond 2012 approaching, European leadership on global warming and energy sustainability is likely to face its greatest challenge to date. In order to remain influential in the years ahead, the European leadership strategy must be credible in terms of measurable results. Yet meeting in early November 2008, a growing alliance of member states has repeated concerns about central features of the integrated climate and energy package, putting to question a tentative consensus reached only weeks earlier in the European Council.[190] With the Czech Republic—whose head of state is known to be one of the most vociferous critics of ambitious climate action within Europe—assuming the Council Presidency in January, the European Parliament gearing up for the summer election season, and the current Commission looking to be replaced in October 2009 is clearly set to become a critical year for European efforts in the area of climate and energy policy.

It may seem ironic, therefore, that renewed impetus for ambitious European climate efforts may come from the other side of the Atlantic, where the recent and overwhelming mandate given by United States voters to the Democratic candidate, Barack Obama, favors a radical departure from the climate policies of the current administration. Scholars have long been mystified that largely similar political, cultural, and socioeconomic circumstances have engendered such divergent approaches to climate change in Europe and the United States.[191] Over the past eight years, however, this rift has grown to become a very real divide, both in the diplomatic arena and in terms of public perception.

With concerns about industrial competitiveness one of the main pressures on continued unilateral leadership by Europe, however, renewed engagement in the international climate process by the United States would send a forceful signal to the global community and also allow Europe to continue its course without needing to worry about the largest economy and per capita greenhouse gas emitter being a freerider. European expectations and hopes for the new administration will be high; and as the European experience has shown, leadership on climate and energy does not always come easily and certainly not overnight. Expectation management may therefore become an important part of the dialogue as transatlantic cooperation resumes a more active pace. Nevertheless, with the election of Senator Barack Obama, a window of opportunity has opened for renewed cooperation on international efforts to mitigate climate change.

The challenges are clear. Without more forceful action by the international community, greenhouse gas emissions are set to more than double within the next four decades;[192] meanwhile, the scientific consensus on the rate and impacts of climate change continues to be revised toward yet more alarming scenarios,[193] with prominent research implying that the costs of inaction will far outweigh the costs of action.[194] At the same time, a world where dominant constraints on economic activity stem from scarce resources and high energy prices offers countless opportunities of industrial transformation through energy efficiency improvements and a transition to sustainable energy sources,[195] rendering climate protection efforts an opportunity to spur economic growth.

Europe has already announced that it will seek to harness the outlined opportunities, forecasting almost a million jobs from its renewable targets and savings of up to €60 billion from its energy efficiency target for 2020.[196] Yet the required changes will not occur without active leadership at the level of governments.[197] A transatlantic alliance has the best prospects of living up to the challenges ahead; for, as has been noted in the past, “there is little that cannot be done if Americans and Europeans agree—but very little that can be done if they do not.”[198] Ultimately, such a transatlantic alliance should find its expression in comparable long-term targets, enhanced cooperation on adaptation and technology deployment, including the financial support of efforts in developing countries, and possibly a trading link between existing and emerging carbon markets in Europe and the United States.[199] Yet the legacy of divide inherited from years of divergent positions and priorities will take some time to mend; in the meantime, open communication, good will, and a willingness to learn from the lessons learned on either side of the Atlantic will be an excellent place to start.

NOTES

1 Created by the Maastricht Treaty in 1993, the European Union (EU) is an overarching framework of intergovernmental cooperation between its member states, but is not a legal subject in its own right and has no derived legislative powers. Instead, supranational legislation–such as the climate and energy policies discussed in this essay–are generally adopted by the European Community (EC), which was established as the European Economic Community by the Treaty of Rome in 1957 and forms one of three "pillars" of the EU; the other two pillars are political cooperation in the area of Common Foreign and Security Policy (CFSP) and Police and Judicial Co-operation in Criminal Matters (PJCC). Like the European Coal and Steel Community (ECSC) and Euratom, the EC is a genuine international organization with legal personality and conferred legislative powers. The EU would have supplanted the EC and thus become a full international organization with the adoption of the failed Constitution for Europe, and has a new chance of doing so with the Treaty of Lisbon. Meanwhile, the ECSC has ceased to exist, with the EC largely inheriting the functions of both organizations.

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