34

AICGS POLICY REPORT

OVERCOMING THE LETHARGY: CLIMATE CHANGE, ENERGY SECURITY, AND THE CASE FOR A THIRD INDUSTRIAL REVOLUTION

Alexander Ochs

AMERICAN INSTITUTE FOR CONTEMPORARY GERMAN STUDIES THE JOHNS HOPKINS UNIVERSITY

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TABLE OF CONTENTS

FOREWORD

Climate change is one of the most important challenges that the world faces today. In addition to the war in Iraq, climate policy was also one of the primary causes of the transatlantic rift. President George W. Bush's refusal to sign the Kyoto Protocol in 2002 was met with complete European incomprehension; in turn, international cooperation on policies combating climate change lacked key U.S. support in the following years. But a new U.S. administration in 2009 could offer a new signal for U.S.-European cooperation on policies combating global warming. Germany, at the forefront of developing alternative energy sources and energy efficient technology, leads European efforts to decrease green house gases—making German-American cooperation on climate policies essential.

Generously supported by the *Daimler-Fonds im Stifterverband für die Deutsche Wissenschaft*, this Policy Report resulted from a conference on "The Third Industrial Revolution: the Economic Case for Climate Policy – A High-Level German-U.S. Dialogue." Furthermore, it provides a prelude to AICGS' new Climate Change and Energy Project and will be followed by three detailed German-American case studies, which will be published in fall 2008. With this project, AICGS aims at invigorating the German-American dialogue on climate change, standing at the center of a European-American dialogue. European-American understanding of the challenge and the solutions will then have to become the heart of international cooperation in order to tackle this urgent problem.

Here, Alexander Ochs, AICGS Non-Resident Senior Fellow, examines the twin challenges of climate change and energy security for the U.S. and Germany, focusing on the third industrial revolution—the revolution that has to occur to transform our current combustion engine-based societies into an energy-efficient and climate-friendly world. The Policy Report analyzes whether we have already started on this path and what policies will have to be implemented in order to make the transition. In this, Mr. Ochs makes a strong economic case for climate action. The Policy Report concludes by examining a new era for transatlantic cooperation on energy and climate change, discussing concrete steps to German-American cooperation in combating climate change.

AICGS would like to thank Alexander Ochs for his insights in this Policy Report and his continuing support with the project as well as the *Daimler-Fonds im Stifterverband für die Deutsche Wissenschaft* for their generous support of AICGS and this publication. The Institute is also grateful to its Publications Coordinator, Jessica Riester, for her help in publishing this product.

We welcome all comments and reactions to this Policy Report as AICGS hopes to further the dialogue with its constituencies interested in climate policy. We trust that this Policy Report will provide the basis for a renewed German-American dialogue on climate change and AICGS is proud to foster this dialogue now and in the future.

Dr. Jackson Janes
Executive Director

ABOUT THE AUTHOR

Mr. Alexander Ochs is an expert on international climate and energy policy. He was a DAAD/AICGS Fellow and currently is a Non-Resident Senior Fellow at AICGS. Between December 2001 and September 2007, he worked as a senior research associate at the German Institute for International and Security Affairs of the Stiftung Wissenschaft und Politik in Berlin where he advised the German government, members of the Bundestag, and other key decision-makers. He has also co-founded and at different times managed, advised, and directed the International Network to Advance Climate Talks (INTACT). Mr. Ochs has co-edited two books and published numerous scholarly articles and policy papers. He has also contributed widely to public media, currently as a weekly commentator for Deutsche Welle, Germany's public international broadcaster. Mr. Ochs has held research or teaching positions at Princeton University, Munich University, Baruch College (CUNY), as well as both Freie and Humboldt Universities in Berlin. He has been a member of the German delegation to the UN climate negotiations and various advisory committees on both sides of the Atlantic. In the beginning of 2008, Alexander founded FACET - Forum for Atlantic Climate and Energy Talks, an independent initiative supported by the AICGS Business and Economics Program. He was a 2005-06 Young Leader of the Aspen Institute, has received various prestigious scholarships and research grants, and currently serves as a an elected member of tt30, a think tank of the Club of Rome.

01 INTRODUCTION

INTRODUCTION

Climate change and the secure supply of energy are among the biggest challenges of the twenty-first century. The problem is immense: While global greenhouse gas (GHG) emissions are currently rising faster than at any given time before, they will have to be halved by the middle of this century in order to prevent the most dangerous effects of global warming. And while energy-related emissions are already responsible for the largest share of GHG emissions, global energy demand is estimated to rise by 50 percent or more between now and 2030.

The key problem we are facing is that our economic system, as it has developed since the second industrial revolution, is fundamentally built on the consumption of fossil fuels. If we do not succeed in altering the ways we produce and use energy, we risk running into a catastrophe open-eyed.

Disagreement between the United States and Germany on energy security and climate change has hampered progress in these two intertwined issue areas for decades. However, both countries currently see an unprecedented amount of debate on the key challenges of higher energy efficiency as well as power production that is sufficient, affordable, and climate-friendly. Opportunities for transatlantic reconciliation on climate and energy issues will further improve in the next two years, but the ground for a return of the United States into an international leadership role on climate and energy must be prepared now.

There are radical changes ahead of us regardless of whether we act on climate change and energy security concerns or not. In both cases, our environment, our economies, our domestic and foreign politics, our societies, and our individual lives will change dramatically. However, they will change in very different ways. With the devastating effects of global warming becoming as clear as the economically disastrous effect of exploding energy prices, the debate to date has been often misleading. Fast and ambitious action on climate change and energy security is often considered to be an "option." As a matter of fact, however, there are no sound alternatives to it. It is in the national interests of both our countries, mandated by environmental, security, and economic concerns, and insofar a patriotic imperative.

What is most needed now is a new, "can-do" attitude and a focus on the various benefits of a well-designed policy approach. Climate change and energy can be seen as Siamese twins insofar as they can only be sustained with concern for one another. While there are indications that a "greening" of our economies is already underway, technology innovation, development, and employment have to occur at a very different pace than currently. Necessary changes are so fundamental that the call for a Third Industrial Revolution seems justified.

This Policy Report starts with an exploration of the comprehensive challenge of climate change and energy security. It then describes what a third industrial revolution could look like and what it will need to induce it. The subsequent section looks at the costs and benefits of action and non-action, making a strong economic case for adoption of the former. It continues with an analysis of the past and present of transatlantic climate and energy policy and detects new opportunities for German-U.S. cooperation in the field for the years ahead. The conclusion offers some suggestions for how the dialogue between both countries can be strengthened.

02

AN ANALYSIS OF THE CHALLENGE

CLIMATE CHANGE AND ENERGY SECURITY: AN ANALYSIS OF THE CHALLENGE

"We also talked about climate, and here we share a common interest: One, we recognize that we have a problem with greenhouse gases; two, we recognize we have a problem with a dependence on oil; three, we recognize that we can use technologies to help solve this problem; and, four, we recognize we have an obligation to work together to promote the technologies necessary to solve."

President Bush, EU-US summit, 30 April 2007[1]

The Challenge of Climate Change

At the beginning of the twenty-first century, the scientific evidence on climate change is overwhelming. The first effects are being felt worldwide, and no leading scientist doubts that human activities are the main cause for this problem. The combustion of fossil fuels, deforestation of large geographical areas, and certain agricultural and industrial practices unleash emissions that are amplifying the natural greenhouse effect. If we do not succeed in reforming our economies, the result will be worsened living conditions at best, a disaster of hardly manageable proportions at worst.

In its newest report of 2007, the Intergovernmental Panel on Climate Change (IPCC), the chief scientific advisory body to the United Nations, states that global warming is by now unequivocal. Global air temperatures have increased by 0.74°C (1.33°F) between 1906 and 2005. Eleven of the last twelve years (1995-2006) were among the warmest since the beginning of data collection in 1850 and "the warmth of the last half century is unusual in at least the previous 1,300 years." The atmospheric concentration of carbon dioxide—the most important greenhouse gas—in 2005, the last year on record, far exceeds the natural range over the last 650,000 years.[2]

The observed effects of this temperature increase include a worldwide decline of glaciers and snow cover, a change of the arctic ice coverage, global average sea level rise, as well as widespread alterations of precipitation amounts and ocean salinity. The last decades also witnessed an escalation of extreme weather events including droughts, heavy rainfall, heat waves and an increased intensity of storms.[3] Looking ahead, the IPCC expects a warming of about 0.2°C (0.36 °F) per decade. If emissions continue to grow unchecked, climate model projections reviewed by the IPCC indicate a further temperature rise of 1.1 to 6.4°C (2.0 to 11.5°F) during the twenty-first century. The effects would be a sea level rise of 110 to 770 millimeters (0.36 to 2.53 ft) between 1990 and 2100, more frequent warm spells, heat waves, and heavy rainfall, possibly followed by a dramatic increase in inland floods. There would be more droughts, more intense storms, and more extreme high tides. Up to 30 percent of plants and animal species would already be threatened in a low temperature increase scenario.[4]

CLIMATE CHANGE EFFECTS ON THE UNITED STATES

Despite the fact that climate change has major regional differences and its effects hit some areas more than others, overall negative consequences

prevail. In the United States, there has been an increase in frequency of weather-related events like storms, heavy rainfalls, and droughts since the 1950s.[5] The southwestern United States has experienced severe drought conditions already since 1999. The 2007 heat waves in the western U.S. (June-September) and across much of the central, southeast, and eastern parts of the country (July-August) were record-breaking events: Drought conditions had terrible effects on farming and destroyed the harvest in vast areas. Fires of unprecedented sizes forced major freeway closures, evacuations, and caused great destruction of property. Heat and fires also killed an uncountable number of animals and caused up to 100 human deaths. The western drought has continued into 2008 while, simultaneously, devastating floods in the Midwest led to the evacuation of thousands of homes. There is evidence suggesting that the annual numbers of tropical storms, hurricanes, and major hurricanes in the North Atlantic have increased over the past 100 years.[6] Six out of the ten most intense Atlantic hurricanes on record occured in the last ten years.[7]

Concerning the future, moderate climate change in the early decades of the century might increase the productivity of rain-fed agriculture in some northern regions, but decrease productivity in other parts of the country. Further warming in the western mountains is projected to cause decreased snow pack, more winter flooding, and reduced summer flows, exacerbating competition for already over-allocated water resources. Disturbances from pests, diseases, heat waves, and droughts are projected to have increasing impacts on forests, with an extended period of high fire risk and large increases in area burned. The disturbing wildfires witnessed predominantly in western parts of the country in recent years might give an indication of such a future. Cities already experiencing long stretches of high temperatures are expected to be further challenged by an increased number, intensity, and duration of heat waves. This would have adverse health impacts, putting older and weaker members of the population most at risk. In addition to these direct negative health impacts, certain tropical diseases could spread to northern regions that had so far been spared. Many of America's major cities are located directly on the coast. These locations could face major land and habitat loss. Particularly for Florida,[8] but also for the Northeast, sea level rise might become a major threat. If the intensity of tropical storms further increases, so will the human and economic losses.

Of course, the United States as a whole is in a strong economic position to adapt to many of these changes, but "adaptation is often expensive, not always possible or successful, and during transitions ecosystems, communities, and individuals could suffer. Moreover, national impact summaries disguise local dislocations and disruptions to the ways we live, work and recreate. Climate change adds a serious stress to our already threatened resources and treasured places."[9]

CLIMATE CHANGE EFFECTS ON GERMANY

In Europe, wide-ranging impacts of climate change have already been documented. These include retreating glaciers, a shift of species ranges, longer growing seasons—but also more droughts—and an increase in inland flooding. In August 2002, a "hundred-year flood" caused by over a week of continuous heavy rains devastated many areas in central and eastern European countries, including Germany. Dozens of people were killed and tens of thousands lost their homes. In 2005, days before Hurricane Katrina hit New Orleans, another flood hit several countries in the same European areas—again not sparing Germany—while at the same time forest fires killed fifteen people in Portugal. From February to April 2006, heavy rain and the melting of unmatched snow masses caused many of Europe's largest rivers including the Elbe and Danube to swell to record levels, causing major destruction. In 2003, a heat wave of unprecedented magnitude struck large parts of Europe. The death toll in France, which was hit hardest, was set at 14,800 people; all over Europe, 35,000 people died.[10]

According to the IPCC, negative impacts in Europe will continue to include increased risk of inland floods, more frequent coastal flooding, and increased soil erosion due to more intense storms and sea level rise. The great majority of organisms and ecosystems will have difficulty adapting to climate change: Mountainous areas will face glacier retreat, reduced snow cover, and extensive species losses—in some areas up to 60 percent, under high emission scenarios, by 2080. In northern Europe, climate change is initially projected to bring mixed effects, including some benefits such as reduced demand for

heating, increased crop yields, and increased forest growth. However, as climate change continues, negative impacts including more frequent winter floods, endangered ecosystems, and increasing ground instability, are likely to outweigh these benefits. In central and eastern Europe, summer rains are projected to decrease, causing higher water stress. In southern Europe, a region already vulnerable to climate variability, the expected increase in temperature and droughts is projected to worsen conditions including water availability and crop productivity. In general, heat waves and the frequency of fires are projected to increase, forest productivity to decline.

In Germany, many ecosystems are already noticeably under stress by climate change. Higher temperatures, altered rainfall patterns, sea level rise, extreme weather events, glacier melt, and river floods—similar to the ones already experienced in 2002, 2005, and 2006—will be Germany's most serious threats.[11] The expected health risks of climate change in Europe are similar to those already mentioned in North America and other temperate zones of this planet.

CLIMATE CHANGE AS A GLOBAL SECURITY RISK

For more than three decades, experts have called for widening the concept of national security to include a far broader range of threats to peace than traditional inter-state conflict, namely global resource scarcity and environmental pollution. However, only recently has "environmental security" entered the international political debate at the highest level; some of the key players of contemporary world politics have declared climate change the most serious global challenge of this century.[12] Climate change can aggravate the risk of intrastate conflict and interstate war over fertile land, food, water, and other resources. Both incremental climate change and rapid weather disasters can worsen living conditions to an extent that they cause people to flee their homes, exacerbating population pressure on neighboring regions. In 2005, half of Bhola Island flooded, leaving 500,000 Bangladeshis permanently homeless. The inhabitants of the Carteret Islands, Papua New Guinea, are another example of people who became climate refugees due to sea level rise, and many more are expected to follow. The IPCC and other scientific experts expect 150 million climate refugees predominantly from regions in Africa, Latin America, and Asia by 2050.[13] These migrants will also knock on American and European doors in their search for shelter. Already, the modest climate change that occurred between the mid 1970s and 2000 is estimated to have caused an annual death toll of over 150,000 lives. At continued emission trends, this number is likely to double by 2020.[14]

Former UN Secretary-General Kofi Annan summed up the challenges posed by climate change, stating:

"Climate change is not just an environmental issue, as too many people still believe. It is an all-encompassing threat. It is a threat to health […]. It could imperil the world's food supply. […] It could endanger the very ground on which nearly half the world's population live."[15]

The Challenge of Energy Security

In a business-as-usual (BAU) scenario, meaning that no political measures to influence these trends take place, the global consumption of oil until 2030 is expected to increase by 37 percent (base year 2006)[16] and the use of natural gas by 63 percent (base year 2004).[17] There is no doubt that this will result in an immense pressure on oil and natural gas supply—current petroleum prices are already rampant. In the future, fewer and fewer supply regions will be able to keep their market share due to decreasing stocks and increasing demand, leading ultimately to a concentration of the international supply of oil and natural gas in states whose political stability is fragile, whose political goodwill is doubtful, and whose adherence to international free-market rules is problematic.[18]

Europe (excluding the states of the former USSR) and the United States, which in 2000 produced almost 50 percent of their oil demands in their own regions, will have to import more than 80 percent of their oil in 2030, according to the International Energy Agency (IEA). They will compete for these imports with other regions, most importantly the booming economies in Asia whose demand will grow even faster. Most of the supply for the increasing demand will have to come from the Persian Gulf and, to a lesser degree, from the Caspian Sea and Russia. Neither of these regions has a record as a very stable and reliable trading partner, proving problematic for Western economies.[19]

U.S. AND GERMAN ENERGY IMPORT DEPENDENCE

The United States is the world's largest energy user, consuming about a quarter of both overall energy and oil production. Oil is the most important primary energy source (41%), followed by natural gas and coal with roughly equal shares (about 23%). The country ranks eleventh in world oil reserves. However, due to high production levels, its proven oil reserves declined by 46 percent between 1970, when drilling in the giant Alaska North Slope started, and 2006.[20] As for the future, tapped U.S.' oil reserves—less than 20 billion barrels—can supply demand for about another decade at current rates of production, and less than a third of that time if the country had to supply its entire demand by itself. As of today, the U.S. imports about 60 percent of its oil. Its imports have exceeded domestic production since the early 1990s. It also imports a substantial portion of its natural gas (slightly over one-fifth). The picture looks very different with regard to coal, of which the country has about 150-200 years supply left in its reserves. Already about a quarter of primary energy and more than half of electricity is generated from coal. Due to expected increases in natural gas and oil prices, among other factors, the consumption of coal is expected to grow further in the future.[21] As of 2006, only about 15 percent of U.S. primary energy is generated from non-fossil fuels (8% nuclear, 7% renewables).[22]

When President George W. Bush said in his 2006 State of the Union Address, "We have a serious problem: America is addicted to oil, which is often imported from unstable parts of the world,"[23] he could have spoken for Germany as well. Germany is the world's sixth largest energy consumer, with oil also being the most important energy source (36%). As in the United States, coal and natural gas follow with roughly equal shares (24 and 23%, respectively); the share of nuclear is higher (13%), that of renewables about the same (6%). The share of imported energy in total energy consumption has increased steadily from 48 percent in 1990 to 61 percent in 2006. The biggest portion of the increase can be ascribed to the growth in German natural gas and hard coal imports, with the latter replacing the more expensive exploitation of domestic reserves. Germany imports practically all of its oil. Despite its high dependence on the import of fossil fuels, Germany has decided to gradually shut down the country's nineteen nuclear power plants by 2020, a decision made by the former SPD-Green Party coalition government and backed by a clear majority of the German public.

Both the United States and Germany are highly dependent on imports of natural gas, but more importantly so, oil. Where they significantly differ is in the energy efficiency of their economies. Whereas Germany's energy consumption structure is very similar to that of the United States (and the rest of the world), the country's efficiency gains of 26 percent in the past decade greatly outpaced economic growth, so that energy consumption in 2006 was not higher than in 1990—or even another ten years earlier.[24] Both countries have differed considerably in terms of government policies and measures toward energy efficiency in the past; they also greatly differ in how they want to deal with the challenge of energy security in the future

ENERGY SHORTAGE AS A RISK TO GLOBAL STABILITY

An increasing number of experts believe that the maximum rate of global petroleum production has already been or is soon to be reached. After this "oil peak," they expect global production to enter a phase of ultimate decline.[25] The escalating shortage would further increase the price of petroleum. Are we going through this phase already? After all, oil production has not increased for years now despite rising demand and escalating prices. No one really has an answer to this question because there is no reliable data on remaining resources and, due to the OPEC cartel that determines supply rates, prices are manipulated and not the result of a free market. It is clear, however, that oil prices that are already breaking historical records have—and will continue to have—enormous negative implications for the global economy as well as for prosperity in those regions which are net importers, including Germany and the United States.

The profiteers of a continuation of the current energy system will be the biggest oil and natural-gas exporting countries. In a BAU scenario, they will gain both in terms of capital and in influence. It is more plausible than not that these countries, which are quite aware of their powerful situations, will employ more radical methods if they believe their national interests are at risk.[26] Some commentators speculate

that rampant energy prices bear a number of high security risks, including wars for resources, particularly oil; state failure and disintegration if the economies of already fragile states end up in complete disarray; and nuclear energy related problems because growing use of nuclear energy in response to the diminishing oil reserves also increases the danger of reactor accidents and the proliferation of weapons-grade plutonium.[27]

Climate Change and Secure Energy Supply: Overlapping Problems, Same Solutions?

Preventing dangerous planetary warming and securing reliable energy supplies both qualify as among the most pressing imperatives confronting scientists and policymakers and a failure to address either topic would have devastating consequences for sustained development on both sides of the Atlantic and elsewhere in the world. How do these two challenges connect to each other?

COMMONALITIES BETWEEN CLIMATE CHANGE AND ENERGY SECURITY

The relationship between climate change and energy security is as follows: 80 percent of global energy supply is produced from fossil fuels which, in Germany and the U.S., are increasingly imported and therefore are at the core of our increasing energy dependence. The burning of fossil fuels also emits CO_2, and energy related CO_2 emissions are responsible for about 60 percent of man-made climate change.[28]

According to the scientific mainstream, it is imperative to avert an increase of the global average mean temperature of more than 2°C (3.6°F) in order to avoid serious and potentially uncontrollable damage. Global warming above 2°C would exponentially increase the risk of so-called tipping points at which ecosystem changes become irreversible and then proceed with gathering pace.[29] To keep global warming below 2°C will require worldwide greenhouse gas (GHG) emissions to peak in the next 10 to 15 years, followed by a sharp decline in order to reach a halving of emissions by 2050, and a reduction of at least 80 percent in the period thereafter.[30] Currently, however, GHG emissions are rising faster than ever before, at a rate of 1.5 percent per year. The IEA estimates that in a continuation of current trends, worldwide energy-related emissions will increase by more than 50 percent until 2030.[31] The U.S. Department of Energy (DoE) calculates a primary energy consumption increase between 3 to nearly 4 times 2000 levels by 2100 in the United States.[32] As a result, global CO_2 emissions could more than triple over the course of this century. Most notably, reversed trends are expected for Germany and the United States (and most other countries): German energy demand is expected to decline by 15 percent until 2030.[33]

The success of climate policy begins with the awareness of a problem of unprecedented dimensions: that our economies are fundamentally built on the burning of fossil fuels. Our entire transportation, agricultural, and industrial systems depend on their affordable supply. So the first link between both challenges, securing energy supply as well as an intact climate, lies in the joint root of the problem: that our dependence on fossil fuels is responsible for both a warming planet and a scarce energy supply. Our dependence on fossil fuels creates an unstable world by threatening our environmental, economic, political, and security systems through climate change and energy scarcity. The second and related link is on the solution side. We will only succeed in solving both problems if we manage to, first, change our consumption patterns, i.e., instead of continuing to squander our energy, consume it far more efficiently and, second, transform our energy production patterns, i.e., achieve a large scale alteration of our energy mix.

DIFFERENCES BETWEEN CLIMATE CHANGE AND ENERGY SECURITY

Higher energy efficiency and a large scale move away from fossil fuels to alternative energy sources like wind, solar, biomass, and hydro will be the key milestones on the way to a climate- and energy-secure world. There are, however, three important differences regarding possible solutions to both topics. First, while a higher usage of domestic coal for heating, electricity generation, and transportation (through liquidification processes) might make sense from an energy security standpoint, under current combustion methods it does not help the climate problem. To the contrary, it would make it a lot worse. Coal is the

source emitting by far the highest amount of CO_2 per energy produced. A solution to this problem would be a sequestration of carbon in the combustion process and its storage in geological formations underground or in the ocean. This technological option might be attractive for both the U.S. and Germany, but more so for the U.S. which, with its many depleted oil fields and abundant saline formations, seems to have almost unlimited storage capacity. If these storage areas should ever "fill up," there is vast and neighboring Canada with a similar potential. The geological storage potential in Germany is rather limited. There are some short-term possibilities, but the bulk of emissions would have to be stored at some distance, either offshore in the North Sea or in neighboring countries. Europe overall seems to have substantial potential, especially if the North Sea is included, but these storage points are not always located near the large CO_2 point sources, unavoidably driving up costs, as the carbon would then also have to be transported.[34]

A second difference becomes apparent if we look at natural gas. While this resource constitutes energy dependence—especially in the case of Germany's high dependence on gas imports from Russia, which has a near monopoly position regarding the supply of Europe—it might be an important intermediate solution to climate change. Indeed, natural gas does emit CO_2—but a lot less per extracted energy unit than the other fossil fuels, namely oil, and particularly coal. In fact, part of a grand climate strategy might be to extend our shares of natural gases until other renewable energy sources become available at such a large scale that they can take over. Against this background, the U.S. and Germany should explore options for diversifying their energy supply with this source. In the case of Germany and Europe as a whole this would mean access to the world's largest gas fields which lie between the Caspian Sea, possibly through a pipeline via eastern Turkey.

Third, nuclear energy is a highly contentious topic on both sides of the Atlantic. The generation of electricity through nuclear fission is a relatively carbon-neutral process. There are some GHG emissions, i.e., through the transport of nuclear fuel rods, but these are rather negligible. However there are a number of current concerns regarding this energy source: negative health effects have been reported in the direct vicinities of nuclear power plants even without registered incidents; major accidents like the ones in Chernobyl, Three Mile Island, Sellafield, Tokaimura, and other plants of course magnify the danger to human health; the operation of nuclear reactors demands massive amounts of fresh water—itself an ever scarcer resource—for cooling; the security of plants can be threatened as targets of terrorist attacks; the safe disposal and isolation from the biosphere of either spent fuel rods from reactors or wastes from reprocessing plants is a permanent source for political scuffle; many doubt the economic efficiency of nuclear plants, pointing to the immense costs of producing nuclear energy;[35] and others point to the fact that the construction of a new nuclear power plant every 30 days for the next 50 years—2,500 new power plants in total—would be necessary in order to fulfill the world's energy needs.[36]

What is particularly relevant in this context is that nuclear is not a renewable form of energy generation. It is dependent on the supply of uranium which is not endless but might soon become a scarce resource itself—at least if nuclear energy is anticipated as a substitute for our vast usage of coal and gas. Investments in nuclear arenas might keep us from inducing a third industrial revolution based on renewable energies and energy security. Against this background, it is not surprising that no new nuclear power plant has come on-line in the United States (the last one was Watts Bar 1 in 1996) or Germany (GKN-II Neckar in 1989) for many years. The DoE chose Yucca Mountain as the location for the repository of nuclear waste but its opening has been delayed repeatedly due to strong resistance to the plan from people living in the area. Germany has already begun to dismantle its oldest reactors as part of its phase-out strategy.

CLIMATE CHANGE AND ENERGY AS SIAMESE TWINS

Some experts see the energy security problem as "immediate, while the potentially greater problem of climate change will unfold over the course of decades and centuries."[37] Others disagree and see a turn of GHG emission trends as more urgent and energy security as a long-term challenge. In fact, both challenges call for major changes to our energy systems, and we will be better off if we act soon and decisively. Many experts today believe that the security and economic well-being of individual countries will

depend more on their ability to free their economies from import dependence on fossil energy sources than on their military capacities.[38]

The issues of energy security and climate change are complex issues that demand multiple solutions. Like Siamese twins, however, they are joined together and cannot be separated without careful consideration of one another. A solution to both climate change and energy security can only be advanced through a two-part solution: enormous energy efficiency gains and a shift from conventional fossil fuels to renewable energy production. The global scale of both problems, too big to be addressed unilaterally by individual countries, and the integration of the global economy imply that cooperation on all levels of political organization, from the global to the local, will be the only viable solution. The required changes are indeed so radical in scale that the term "revolution" seems justified. To induce such a third industrial revolution makes ambitious political programs designed to rapidly exploit energy efficiency potentials and advance non-fossil fuel energy sources. Transatlantic cooperation should be a key part of industrial and political reform—and will be addressed in the two subsequent chapters.

03

THE THIRD INDUSTRIAL REVOLUTION

THE THIRD INDUSTRIAL REVOLUTION: HOW IT MIGHT LOOK - OR IS IT ALREADY HAPPENING?

"Climate change, and how we address this issue, is a defining issue of our era. […] We have an ever expanding arsenal of technologies to address the threat and also have significant resources at our disposal. What we are desperately in need of, at this time, is political will at the leaders' level."

Secretary-General Ban Ki-moon, Heiligendamm, 8 June 2007[39]

During the later part of the eighteenth to the middle of the nineteenth centuries, the first industrial revolution brought dramatic changes to Europe and the United States when the manual labor-based economy was, due to inventions and technological innovations, increasingly replaced by an economy shaped by industry and machinery. Vast masses of the working-class population formerly laboring in agriculture moved to the cities in search of better employment in industrial production. It merged into the second industrial revolution when economic and technological development led to the invention and wide deployment of steam-powered boats, railways, and later, with the innovation of the internal combustion engine, the generation of electrical power.

The Possible Design of a Climate-Friendly, Energy-Secure Future

The burning of coal—and later oil and natural gas—for heating, mechanical operation, electricity generation, and transportation was the main driving force of both industrial revolutions. These revolutions marked major turning points in human history, comparable to the invention of farming, the wheel, or the development of the state system. Despite their rather gradual progress stretching over many decades, these processes are called revolutions because they influenced almost every aspect of human life and society. The burning of fossil fuels began an era of unparalleled technological development, economic growth, and—at least for most—an improvement in the quality of life. Today, however, we are faced with the ecological consequences of this development. The industrial revolutions were responsible for different aspects of local pollution, some of which has improved over time through the replacement of coal by gas and oil and also cleaner coal, clean technologies, and environmental regulation. Most importantly, however, fossil-fuelled energy generation is responsible for today's enormous global challenge of climate change and has lead to "an international energy crisis of unprecedented proportion."[40] If we want to solve these problems, energy, generated from different sources and used more efficiently, will have to be at the heart of the third industrial revolution as well.

ENERGY SAVINGS AND ENERGY EFFICIENCY

How might such a third energy revolution look? Energy savings and efficiency gains can be considered the first important step in any grand-design strategy. Together, they could account for up to half the CO_2 reductions needed to keep global temperature rise below 2°C. All sectors of the economy including households, transportation, and businesses

can be made more energy efficient. There are fundamental ways of how to increase energy efficiency, only some of which are mentioned here.

Buildings consume nearly a third of America's energy. Some energy savings actually come at no cost at all. Take the example of white roofs, which cost almost the same amount to construct as black roofs, yet, since they reflect the heat and therefore cut down on air conditioning needs, save enormous costs in energy over the life of a building.[41] Likewise, the inexpensive installation of so-called "smart meters" provide real-time information and thereby make billing more transparent to customers, giving them more of an incentive to cut down on costs. Using fluorescent light bulbs can save more than $15 a year per piece. In general, efficiency technologies vary in up-front expenses but once they are installed, they save energy and cut down on its cost. Including efficiency considerations in planning new buildings is a lot cheaper than installing these technologies later. Energy (and cost) saving opportunities with existing technologies are estimated at 70 percent to 90 percent in areas such as lighting, fan, and pump systems; 60 percent for heating, cooling, and electronics; and 50 percent for electric motors.[42]

In the transportation sector, many technologies are already available to improve fuel efficiency at low costs. These include conventional hybrid vehicles which combine an internal combustion engine with an electric motor. The hybrid cars already on the market can improve fuel efficiency between 30 percent and 50 percent in city driving (if the technology is used for efficiency gains and not for acceleration). Each year new and more hybrid models are on the market. A second technology that would significantly reduce fuel consumption is the clean diesel engine. Older diesel cars exhaust large quantities of sulfur and are therefore still a lot less popular in the United States than in Europe, where they account for about half of new car sales, because diesel engines are up to 40 percent more efficient than those powered by gasoline. Clean diesels use a higher fuel quality and modified engines which control soot exhaust. There are many other options in the automobile sector which could significantly increase the efficiency of vehicles, including transmission, lubricants, and valve-timing technology.[43] An even more efficient way to address the issue of energy consumption in the transportation sector is walking, biking, and using mass transportation. There is no doubt that more people would use these options if their use would be more easily accessible, cheaper, and safer—if they are currently an option at all. Conversely, if more people would use these means of travel, these technologies would develop faster. To support this would mean major adjustments to our transportation infrastructure from bike lanes to new high-speed trains. As of today, in most German cities it is common to see over 50 percent of all trips being made on public transit, bikes, or by walking. By comparison, Portland, Oregon, leads the U.S. with only approximately 20 percent of trips on bike, by foot, or on public transportation.[44]

RENEWABLE ENERGIES

The second major area of action is the production of energy through the exploitation of non-fossil fuel sources. In the field of renewable energy, decades of technological progress have seen innovations such as high-efficiency wind turbines, photovoltaic panels, biomass power plants, and solar thermal collectors become domestic market and export hits. The EU, U.S., and global markets for renewable energy are growing dramatically. In 2006 the worldwide turnover was $38 billion, 26 percent more than the previous year.[45] In recent years, the frontrunners, wind and solar power, have increased their share by more than 20 percent per annum globally. In the United States, wind energy grew 45 percent in 2007, the third consecutive year of record-setting growth—and it is on track to set a new record this year.[46] In what Daniel Yergin, chairman of the Cambridge Energy Research Associates, calls "the great bubbling," venture-capital funding in the green-tech sector hit $5.18 billion in 2007, an increase of 44 percent from the year before.[47]

According to optimistic reports, renewable energy can deliver 35 percent of the world's primary energy needs by 2030 and half of it by 2050, despite a phase-out of nuclear usage. According to these studies, 70 percent of electricity and 65 percent of heat could be produced from renewable resources by the mid-twenty-first century.[48] To make these scenarios happen, all major renewables including solar, wind, hydro, geothermal, biomass, and ocean waves would need to be further advanced and employed in all sectors of the economy and all areas of human life, from homes to offices to vehicles. Even in a rather conservative assessment, renewable

potentials are enormous. Energy insiders have calculated that an area the size of 114 square miles in the southwestern U.S. could produce enough solar electricity to power the entire country.[49] This is only negligibly more than the size of the New York City borough of Queens (at 109 sq. mi.). The DoE believes that wind power could cover 20 percent of U.S. electricity demand.[50]

One of the key problems with the oil age is that there seem to be no alternatives to it, in particular in the automobile sector. Conventional hybrids run more efficiently but they still run on gasoline. In the future, more and more cars could drive on biofuels. While current biofuel production in most northern countries like the U.S. and Germany is based on corn which—due to the high energy input it needs and the low efficiency it provides—is only a marginal solution in terms of GHG reductions, future production based on switchgrass and other cellulosic plants would bring significant improvements in the "carbon footprint" of automobiles. In the electricity sector, the modifications to our infrastructure, however, would be immense. One main example is the revolutionary change regarding the configuration of our energy structure. Today's centralized energy systems would have to morph into networks connecting millions of individuals who produce renewable energy locally using their roofs, their gardens, and their backyards.

OTHER TECHNOLOGICAL REVOLUTIONS

In our modern societies, there will never be a local energy system where every individual will be able to cover his or her own energy demand. So-called "smart grids" will be needed where those who produce more than what they need can feed extra capacities into the grid which can then be used elsewhere. Other aspects of a new industrial era will be essential to make a revolutionary change of the energy system a reality. For example, many innovations of the information technology (IT) age including PCs, mega-computers, Internet, and wireless communication technologies are key technologies that can be used to steer the energy network:

"Just as second generation information systems allow businesses and individuals to connect with millions of desktop computers via the Internet, millions of local producers of renewable energy can potentially produce and share far more distributed power than the older centralised forms of energy—oil, gas, coal. […] The same design principles and smart technologies that made possible the Internet, and vast distributed global communication networks, will be used to reconfigure the world's power grids so that people can produce renewable energy and share it peer-to-peer, just like they now produce and share information, creating a new, decentralized form of energy use."[51]

Such a fully-integrated, smart "intergrid" would also have to be put in place on a larger, regional scale like the European Union and North America. EU member states or individual U.S. states would be able to sell renewable energy surpluses to those states in need of it to ensure supra-state energy security.[52]

One of the problems often presented against the practicability of a large-scale employment of renewables is common-sense: "the wind does not always blow, the sun does not always shine." One way to store overcapacities (or "back-up energy") during production times is in high-capacity batteries. Much research is currently underway in this field. Another option is hydrogen. Hydrogen is often thought of as a renewable energy source, which it is not. To the contrary, it needs a lot of energy to be produced. The key advantages of hydrogen are that first, it is a great medium for permanent storage of energy; second, injected in fuel cells, it can be used to power mobile appliances including personal vehicles and trucks; and third, it burns clean, i.e., there are no tailpipe emissions including GHGs. Already in 1874, a character in a Jules Verne novel said, "I believe that water will one day serve as our fuel, that the hydrogen and oxygen which compose it, used alone or together, will supply an inexhaustible source of heat and light, burning with an intensity that coal cannot equal."[53]

In order "[t]o reduce oil dependence, nothing would do more good more quickly than making cars that could connect to the electric grid. […] Plug-in hybrid electric vehicles are a game-changing technology. They can break our oil addiction, cut driving costs, and reduce pollution."[54] David Sandalow , former U.S. Assistant Secretary of State for Oceans and International Environmental and Scientific Affairs, believes that plug-in hybrids, i.e., cars whose batteries can be connected directly to the electrical grid, could be charged at night using excess power from existing power plants, meaning that no new plants would have

to be built. Again, to have no impact on the climate, the electricity would have to come from renewable energies. However, as Sandalow calculates, even when powered by electricity derived from "dirty" coal, there would be a positive effect on GHG emissions. The reason is that the efficiency of even an old coal plant is by far higher than the internal gas-guzzling combustion engine of a conventional car.

The Green Technology Boom: Aren't We There Yet?

Exploding oil and gas prices and concern about climate change have already started to alter our energy system and economies. Improved technologies from compact fluorescent light bulbs to combined cycle electric power plants have demonstrated the possibility of enormous energy efficiency improvements. Hybrids are already an important part of the American and—to a lesser degree—the German vehicle fleet. The Toyota Prius alone has sold more than one million cars worldwide, and some experts estimate that by 2012 more than 40 models will be hybrids, accounting for a production of 650,000 vehicles per year.[55] Germany's enormous efficiency gains over the last three decades have demonstrated that major progress in some other areas is also already happening.

TOO LITTLE, TOO SLOW

A green revolution seems to be already underway. However, the problem remains that it is not fast and not radical enough to substantially tackle the problems of climate change and energy security. In 2004, renewable energy sources worldwide still provided just over 13 percent of global primary energy of which combustible renewables (i.e., wood) and renewable waste (landfill gas, waste incineration, solid biomass, and liquid biofuels) comprised 10.6 percent and hydro 2.2 percent. The "showcase" renewables geothermal, solar, wind, and tide energy accounted for a total of 0.5 percent.[56] Despite the recent boom of green technologies in the United States and Europe, their renewable share of overall energy production is even smaller than the global average, with about 7 percent and 8.5 percent, respectively.[57]

Clearly, each economic actor's decision to save costs through saving energy, each company offering green products, each individual changing his or her lifestyle makes a big difference and should be encouraged—but compared to the overall growth in energy demand and greenhouse gas emissions, this is nowhere near enough. The problem is simply that economic growth and per capita consumption outpace the current speed of green innovation. Consequently, the last available data is not promising: energy-related CO_2 emissions in the United States grew by 1.6 percent in 2007 compared to 2006, in Germany by 0.6 percent in 2006 compared to the year before.[58]

THE NEED FOR RADICAL CHANGES OF INVESTMENT STREAMS

For the future, studies show the urgency of a far more radical move toward a low-carbon revolution in order to face the double challenges of energy security and climate change. The DoE's U.S. Climate Change Science Program expects non-fossil energy use to grow from over four to almost nine times over the course of the century in its BAU scenario—an impressive number indeed—"but this growth is insufficient to supplant fossil fuels as the major source of energy."[59] The EU Commission calculates that in 2050 non-fossils (renewables and nuclear) will provide 30 percent of energies worldwide and even 40 percent in Europe—still, total energy consumption in the world would more than double! For Europe, the increase would be modest, but it would still be an increase.[60]

Within the next decade, many existing power plants in the OECD countries will come to the end of their technical lifetime. The technology by which they are replaced will be critical for both the twin problems of climate change and energy security. "A decision taken to construct a coal power plant today will result in the production of CO_2 emissions lasting until 2050. So whatever plans are made by power utilities over the next few years will define the energy supply of the next generation."[61] The current incentives seem to be not enough. Governmental action will have to play the key role.

04

MAKING THE ECONOMIC CASE FOR CLIMATE ACTION

MAKING THE ECONOMIC CASE FOR CLIMATE ACTION

"It's extremely clear and is very explicit that the cost of inaction will be huge compared to the cost of action. We can't afford to wait for some perfect accord to replace Kyoto, for some grand agreement. We can't afford to spend years bickering about it. We need to start acting now."

Jeffrey D. Sachs, head of Columbia University's Earth Institute[62]

For a long time policymakers faced a fundamental problem in designing appropriate policy actions to address climate change and fossil fuel dependence, as they suffered from two major information gaps: first, the economic cost of potential damages arising from climate change was unclear and, second, the cost of mitigating GHGs was highly uncertain. These twin gaps significantly reduced the quality of the climate policy debate.[63] Only recently have these information gaps narrowed as society begins to understand the devastating effects of unstopped climate change and as the economic discussion of the costs of climate and energy action includes potential economic benefits of these policies.

The environmental and health—as well as the international and energy security—effects of climate change were described in the first section. The second section has shown that there are a variety of technological options to reduce carbon emissions already at hand and a lot more are currently being developed. But how much will it cost to induce a third industrial revolution in order to tackle the immense problems of climate change and energy security? The economic side of a climate change and energy revolution is the key focus of this chapter.

Basic considerations

The question of how much it will cost to prevent climate change is not easy to answer. Theoretically, nature offers many options for producing energy at no cost at all: sunlight, wind, ocean tides, river water, and even biomass exist in abundance and can be used for minimal cost and with minimal environmental impact. The question, of course, is how to turn these renewable resources into power, electricity, and heat as efficiently and cost-effectively as possible. A wind mill is a good example: Once it is in place it delivers power literally for free whenever there is wind. There is no need to continuously supply scarce resources to power the plant. Similarly, energy efficiency measures have higher upfront costs, sometimes substantial—yet, once they are installed, electricity used and energy costs are reduced. Why then have these technologies not yet been installed at a larger scale?

THE POLLUTER-DOES-NOT-PAY PRINCIPLE

Obviously, the cost question is complicated and has to be approached from a variety of perspectives. One reason for the continued use of fossil fuels is that, at least for most of the last century, they have been inexpensive themselves: bottled water was more expensive than the same amount of oil. From this angle, the problem was not that alternative energies were so expensive, but rather that fossil fuels were so incredibly inexpensive. They were considered cheap because we either did not know about the hazardous consequences of their burning and the heavy substi-

tute system needed to keep them cheap; or we simply did not care because we saw no alternative to fossil fuels and "everybody" profited from their low cost.

It seems that we are slowly coming to terms with our short-sightedness. The fact that fossil fuels were so inexpensive is a rather extreme violation of one of the basic principles of environmental policy, the polluter-pays principle, stipulating that the party responsible for the pollution pays for the damage done to the natural environment. The burning of fossil fuels has always been accompanied by immense costs to society: Health (and healthcare) costs as well as the tax-supported investments in a large-scale, world-spanning, heavily centralized supply system are colossal. There is a real need for a comprehensive assessment of these costs in our current energy, transportation, security, and other budgets—the results would be eye-opening. Society as a whole, not just the individual using the commodity, has always paid an enormous price for maintaining a fossil-fueled economic system.

Writing about oil, Sandalow points to the fact that "[m]ost goods in our economy have substitutes. If the orange crop fails and the juice prices rise, for example, you can switch to milk, soda or water. But when it comes to oil, there are no widely available substitutes. If events in some distant land cause gasoline prices to rise, you have two choices—pay more or drive less."[64] Were there really no alternatives? Oil is usually the most prominent example when it comes to this argument. But Sandalow continues: "We grew up with this lack of substitutes, as did our parents and grandparents. We consider it normal. But it is deeply abnormal. (What other essential commodities have no substitutes?) It damages our national security, natural world and pocketbooks."[65] Long before climate change and fossil fuel scarcity became a part of the equation, the problem with our addiction to fossil fuels was simply that the price society paid was not—or only to a small degree—internalized in the consumption price. Now that these social costs are increasingly part of the bill, that bill has become a lot more expensive.

THE NEED FOR PRICE SIGNALS

The truth is that price matters for people's consumption patterns—and often more so than environmental awareness and ideals. Indeed, with gas prices at $4 a gallon (still only half of the German price), Americans are starting to conserve energy. "Al Gore came out with a movie called 'An Inconvenient Truth' in 2006, when Hummer sales were still good. The inconvenient truth, in fact, is that prices are what matter. With gas prices soaring, Gore is going to get his collapse in Hummer sales, not because people went green, but because they wouldn't spend the extra green to buy the gas."[66] As General Motors contemplates selling off its Hummer division, it is clear that companies must readjust their products to reflect the new consumer demand dictated by increasing energy prices. Consumer habits are changing—the Federal Highway Administration estimates that in March 2008 Americans drove 4.3 percent fewer miles than they did in March 2007—and economies will change accordingly.[67]

Many commentators who used to criticize renewable energies as too expensive for our economies now argue in favor of additional subsidies for fossil fuels. Likewise, many institutes that have long vehemently lobbied against climate regulation and higher fossil-fuel taxation[68] now find the United States little prepared for the recent spike in energy prices. While some U.S. experts forecasted an economic Kyoto doomsday for EU member states,[69] they see these countries currently going through a major economic boom while the U.S. economy fears a recession. Clearly, different reasons have played a role in Europe's current economic success, but the acceptance of energy as a scarce (or at least expensive) resource might well play a major role in it. Indeed, more and more observers believe that the economic balance of power among major industrial states will change according to their relative abilities to adapt to a scarcity of fossil fuels.[70]

Consequently, Thomas Friedman, together with energy economist Philip Verleger, Jr., advocates a "price floor" for gasoline of $4 a gallon for regular unleaded. The federal government would take care that the price never falls below that level, adjusting the federal gasoline tax accordingly: "We need to make a structural shift in our energy economy. Ultimately, we need to move our entire fleet to plug-in electric cars. The only way to get from here to there is to start now with a price signal that will force the change." There can be no doubt that the higher price drivers have always paid at the German gas pump accounts for the differences in driving behavior (Germans drive less

frequently) and have resulted in a push for German mass transportation systems.

Energy scarcity has an increasing toll on the prices of oil and natural gas. Despite the fact that the impact of their burning on the environment is not yet reflected in their costs, alternatives have already become a lot more attractive because of these price trends. According to analysts, there is no end in sight for price escalation in oil and natural gas.[71] Unfortunately, however, not only clean renewables become more affordable through the relative price increase of oil and gas. The same holds true for coal which is available in relative abundance in both the United States and Europe (and many other parts of the world), but has an even stronger negative effect on the climate than natural gas and petroleum. Therefore, to give renewables a fair chance in an open market, the price societies pay for burning all three major types of fossil fuels will have to be reflected in their use.

Global Estimates

Looking at some of the estimates of the most renowned scientific bodies might give us some indication of the cost of action for reducing climate change and our dependence on fossil fuels. The IPCC reviewed different international cost estimates and concluded that "[i]n 2050 global average macroeconomic costs for multi-gas mitigation towards stabilization […] are between a 1% gain to a 5.5% decrease of global GDP."[72] It is important to note that the IPCC does not include the costs of non-action, i.e., the price that would have to be paid for adapting to climate change effects in the absence of mitigation efforts.

ADDITIONAL INVESTMENT FROM NEGLIGIBLE TO 5-10 PERCENT

The panel also looked at the energy production sector more specifically: Future energy infrastructure investment is expected to total over $20 trillion between now and 2030. IPCC estimates show that returning global energy-related CO2 emissions to 2005 levels by 2030 would require a large shift in the pattern of investment, although the net additional investment required "ranges from negligible to 5-10%."[73] The IPCC also discovered many "low-hanging fruits." To give one example: "By 2030, the IPCC estimates that about 30% of the projected GHG emissions in the building sector can be avoided with net economic benefit."[74]

The McKinsey Global Institute has similar findings. It released a comprehensive cost curve for global greenhouse gas reduction measures which concluded that the measures needed to stabilize emissions at 450 ppm have a net cost near zero because the negative-cost efficiency measures would just about compensate for the higher cost of fuel in the future. On a global scale, McKinsey estimates that "additional annual investments in energy productivity of $170 billion through 2020 could cut global energy demand growth by at least half—the equivalent of 64 million barrels of oil a day or almost one and a half times today's entire U.S. energy consumption." These investments could save $900 billion per year in energy costs.[75] In the case of the McKinsey estimates it is important to note that its assessment is made even against much lower energy prices than what we have recently witnessed.

Some reports mention but only few integrate co-benefits into their cost-benefit-assessments. However, local air pollution abatement and health co-benefits are important to the economic case for climate change: "[W]hile studies use different methodologies, in all analyzed world regions near-term health co-benefits from reduced air pollution as a result of actions to reduce GHG emissions can be substantial and may offset a substantial fraction of mitigation costs. […] Integrating air pollution abatement and climate change mitigation policies offers potentially large cost reductions compared to treating those policies in isolation."[76] Including co-benefits other than health, such as increased agricultural production and reduced pressure on natural ecosystems, would further enhance cost savings. In Europe, the recent rise in food prices has been linked, among other factors, to additional pressure on supply created by climate change and rising cost of crude oil and natural gas, which in turn raises the cost of nitrogen fertilizer.[77] Another key benefit would be more stable energy prices through the enhanced use of renewable energies. Many experts do not see the economy at risk because of high energy prices, per se. The real danger is the volatility of prices. Renewable energies can therefore be seen as a hedge against future utility rate volatility.[78]

AMBITIOUS ACTION FAR OUTWEIGHS ECONOMIC COSTS OF NOT ACTING

The British government asked Sir Nicolas Stern, former chief economist of the World Bank, to assess the economics of climate change. In 2006, the so-called Stern report, probably one of the most-cited economic reports of all times, was published. The findings of this report have had a profound impact on the discussion of climate change mitigation costs. The commission assessed a wide range of evidence on the impacts of climate change and on the economic costs, employing a number of different methods to assess costs and risks: "From all of these perspectives, the evidence gathered by the Review leads to a simple conclusion: the benefits of strong and early action far outweigh the economic costs of not acting." The review estimates that if we do not act, the costs of climate change will be equivalent to losing at least 5 percent of global GDP each year. If a wider range of impacts is taken into account, the estimates of damage could even rise to 20 percent of GDP or more. According to the Stern report, the costs of action—reducing GHG emissions to avoid the worst effects of climate change—can be limited to around 1 percent of global GDP each year.[79]

The Stern report further emphasizes the necessity of early action. The investment made in the next 10-20 years will be so crucial for the future of Earth's climate that the commission is not shy of a dramatic historical comparison: "Our actions now and over the coming decades could create risks of major disruption to economic and social activity, on a scale similar to those associated with the great wars and the economic depression of the first half of the 20th century. And it will be difficult or impossible to reverse these changes."[80]

National Cost Assessments

The debate in Washington and elsewhere has increasingly turned to the question of how much it will cost to address climate change. A national cost assessment is admittedly a daunting task and different interests in its outcome have further complicated the picture. Regardless, we need policy frameworks that direct investments in the right direction and get the solutions on the market and in use.

DIFFERING COST ASSESSMENTS

"[C]omplying with Kyoto will reduce German GDP by 2.8 percent in 2010 and cut employment by 1 million jobs."[81] The American Council for Capital Formation, the National Association of Manufacturers, and many other "free-market" think tanks and industry groups often present numbers—such as these—to their audiences (including the U.S. Congress and public media) to specify the economic disaster that mandatory action on climate and energy alternatives would have in the future or, in some cases, already have had in the past. It is important to be aware of the fact that none of these analyses appear in the peer-reviewed literature. This is a clear parallel to the literature doubting the human influence on climate change. Naomi Oreskes found that of 928 articles published in refereed scientific journals between 1993 and 2003 that were listed in one of the premier scientific research platforms (the ISI database) with the keywords "climate change," not one was in disagreement with the argument of a human modification of the climate.[82] Still, the public media, all for "balanced reporting," kept the view of a very small group of commentators (some with no education in relevant sciences) alive that this was still debatable or simply wrong.

The exaggeration of action costs in large-scale economic assessments of national environmental policies has some tradition. Almost twenty years ago, the Environmental Protection Agency (EPA) assessed the costs of the SO_2 Title of the Clean Air Act of 1990, the first and largest cap-and-trade pollution control system in the U.S. The estimate was that SO_2 permits would cost $500-$1000 per ton. In fact, prices have consistently been between $100 and $200 per ton. The costs of the program were at least 40 percent less expensive than originally estimated.[83] Many private analysts had even higher numbers than the EPA, concluding that reductions of the pollutants responsible for acid rain would be too expensive, cost jobs, and drive up electricity costs. In reality, electricity expenses went down in most states after the passage of the act. Job losses did occur, but those related to the program accounted for approximately 5 percent while the remaining 95 percent were due to other reasons, most importantly mechanization which would also have occurred without the Clean Air Act. Furthermore, the job losses must be seen in relation to the many new jobs which were created through the

development of an environmental market and technological innovation. A 2003 Office of Management and Budget (OMB) study found that "the Acid Rain Program accounted for the largest quantified human health benefits—over $70 billion annually—of any major federal regulatory program implemented in the last decade". Altogether, "benefits exceed[ed] costs by more than 40:1."[84]

ECONOMIC MYTHS

In the economic debate it is not always clear how some analysts arrive at their figures. Often these figures cannot be verified because the methodology is not accessible. There have also been cases of blatantly improbable business-as-usual scenarios as reference cases regarding, i.e., emission increases, economic growth, or business and consumer behavior. In addition, many of these estimates do not account for technological change and the potential for innovation once the policy and market framework is set. Most importantly, however, these numbers are simply not cost-benefit analyses, but just cost-analyses, i.e., they neither account for the benefits of actions (that might occur in parallel to costs) nor for the costs of inaction:

"The claim that climate protection is 'too expensive' treats it like a discretionary expense—perhaps like a luxury car or exotic vacation that is beyond this year's budget. No harm is done by walking away from a high-end purchase that you can't quite afford. But if we walk away from climate protection, we will be walking into danger. Unless we act now, the climate disruption will continue to worsen, with health, economic, and environmental costs far greater than the price of protection."[85]

In the current debate on climate change and energy, one of the most prominent myths is that "Economic growth will necessarily be accompanied by an increase in energy demand."[86] Historical experiences actually do not support this view at all. The combined EU economy is roughly twice as energy-efficient and half as CO_2-intensive as the United States, without any direct correlation to economic growth. Denmark, for example, has stabilized its CO_2 emissions over the last twenty-five years while growing its economy by 75 percent. Its initiatives to promote energy efficiency and renewables do not seem to have reduced Denmark's quality of life or economic performance.[87]

California, too, has managed to allow for strong economic growth while implementing aggressive energy efficiency policies. California's per-capita electricity consumption has not increased over the last thirty years and is now more than 40 percent lower than in the rest of the United States. Meanwhile, California's economy grew a lot faster than the rest of the country, by more than 50 percent (in real terms) in the fifteen years from 1990 to 2005 alone.[88] California's energy efficiency regulations according to a Stanford University study saved consumers and businesses $56 billion since the 1970s.[89] One important lesson from the past is that economic assessment models often seem to be unable to take account of the immense forces of human ingenuity, creativity, and technological innovation that are unleashed when confronted with a new reality. New regulatory frameworks, new markets, and new price signals together form such a new reality.

THE HUGE POTENTIALS OF ACTION

On 29 May 2008 more than 1,700 prominent scientists and economists released a joint statement calling on policymakers to require immediate, deep reductions in heat-trapping emissions that cause global warming. The statement notes that acting swiftly would be the most cost-effective way to limit climate change. Conversely, delaying national action would mean that future cuts would have to be more drastic and much more expensive. On the one hand, those increased mitigation costs would come in addition to the increased cost of adapting to a higher degree of climate change. Immediate action and "smart reduction strategies," on the other hand, would allow the economy to grow, generate new domestic jobs, protect public health, and strengthen energy security.[90]

Another report is more concrete and calculates the long-term cost of unmitigated climate change to the U.S. at 3.6 percent of GDP or $3.8 trillion annually (in today's dollars) by the turn of the next century. Four impacts alone—hurricane damage, real estate losses, energy expenses, and water costs—would eat up 1.8 percent of U.S. GDP or almost $1.9 trillion a year in today's dollars.[91] Against this, German mid-term adaptation cost estimates almost come across as small: The German Institute for Economic Research (DIW) calculated that climate change in the Federal Republic might cost €800 billion until 2050. Its cost

calculation includes damage by floods, droughts, forest fires, and severe storms as well as higher costs for energy and protection measures such as the (re)construction of dikes.[92] The Federation of German Industries (BDI), together with McKinsey, recently published a microeconomic analysis of all integral climate protection technologies, including indicators of costs. Germany is the first country worldwide to obtain such detailed data. The study suggests that a reduction of German GHG emissions by 26 percent by the year 2020 (in comparison to the year 1990) in the building, industry, energy, and transportation sectors is economically achievable with proven technologies and without hurting economic growth and quality of life, even if the phasing out of nuclear energy occurs as planned.[93]

In another study on the U.S., McKinsey found that by "[r]elying on tested approaches and high-potential emerging technologies, the U.S. could reduce its greenhouse gas emissions in 2030 by 3.0-4.5 gigatons of CO_2 emissions."[94] This would equal a 7 to 28 percent reduction in GHGs from 2005 levels "and could be made at marginal cost." Forty percent of reductions would even generate direct economic benefits. Energy efficiency in the buildings, appliances, and industrial sectors alone could offset some 85 percent of the projected incremental demand for electricity in 2030. Other studies have found that investments in energy efficiency technologies can cost-effectively reduce U.S. energy consumption by 25 to 30 percent or more over the course of the next 20 to 25 years.[95]

CAP-AND-TRADE SYSTEMS IN THE EU AND U.S.

Entrepreneurs will only invest in developing and deploying low-emission technologies at a large scale if a market for these innovations is established. There are many ways to establish such a market and they are not mutually exclusive. To the contrary, a strong point can be made that in order to tackle the enormous problem of climate change and to induce an energy revolution, we will need a patchwork system of regulations and incentives on all levels of political organization ("from the global to the local") covering all relevant economic sectors. Research on the economic effects of most of these different approaches is still in its infancy. All of these different approaches cannot be discussed in detail here; instead, the report will concentrate on a few prominent proposals. The most-discussed market instrument for GHG reductions is emission trading (or "cap-and-trade")[96] which is prominently featured in the Kyoto Protocol as one of its "flexible mechanisms" to achieve reductions most cost-effectively.

The European Union Emission Trading System (EU ETS) is currently by far the largest such scheme in the world. It covers more than 10,000 energy and industrial installations which together represent approximately 40 percent of the EU's overall CO_2 emissions. The EU ETS is one of the major pillars of the EU's climate policy. Experiences with the system in the first trading period (2005-2007) are mixed at best. The system worked technically; it established a carbon price and businesses began incorporating this price into their decision-making; however, it is currently debated whether the system led to any considerable reductions. One main reason for this is that tradable emission allowances were significantly over-allocated by several member states. Consequently, the price for allowances fell over time to a point where a real economic signal no longer existed (in September 2007, the price per ton CO_2 was €0.10). However, in their otherwise justified criticism, most observers overlook the fact that from the very beginning this first phase of the EU ETS was foreseen as a pilot phase in which the system would be tested and later readjusted. The market infrastructure for a multi-national trading program is now in place. The EU seems committed to learn from the system's "birth deficiencies." The Commission has announced that it will toughen up the system in the second phase (2008-2012). Resulting reductions for this second trading period are projected to be 7.4 percent by 2012. If they materialize, these reductions stimulated through emission trading will make up a major share of the Union's Kyoto reduction target.[97] Due to its many deficits in the first trading period, economic assessments of the EU ETS at this point are not meaningful.[98]

The U.S. is still debating its market approach to regulating GHG emissions. Current discussions indicate that a cap-and-trade-system might play a key role in U.S. climate policy as well. The proposal most prominently discussed at the time of writing is the Lieberman-Warner Climate Security Act (LWCSA, S.3036). The LWCSA would establish a market-based cap-and-trade program for GHG emissions and establish other measures to reduce GHG emis-

sions. An estimated 87 percent of U.S. emissions would be subject to the emission trading. The bill aims at reducing emissions from these covered sectors by 4 percent below 2005 levels by 2012; 19 percent below 2005 levels by 2020; and 71 percent below 2005 levels by 2050.[99]

The advocacy group Environmental Defense Fund recently conducted a meta-analysis of studies looking at the impacts of LWCSA on the U.S. economy.[100] It surveyed all currently available models from those independent sources that were willing to make their results and assumptions completely transparent: one run by the Massachusetts Institute of Technology (MIT), two by the Department of Energy (DoE), and two contracted by the Environmental Protection Agency (EPA). The median estimate among all five studies is that ambitious climate policy will reduce annual economic growth by only three-hundredths of a percent (0.03 percent). Over the period 2010 to 2030, the models estimate a reduction of just one-half of one percent of GDP, compared to projected economic growth over the same twenty year period of 70 percent.

To put this into perspective, under business-as-usual, the total output of the U.S. economy is projected to reach $26 trillion in January 2030. With a cap on greenhouse gases, the economy will get to that level three months later, by April.[101] Once again, it is important to note that none of the five reviewed models included the costs of inaction, i.e., the damages that will result from unchecked global warming. But again, immediate action is warranted: If serious action is not taken until 2030 it would require annual emission cuts of over 6 percent to reach the same reduction levels in 2050 compared to action implemented in the next few years; waiting until 2040 would mean almost 17 percent per year.[102] Reductions of this magnitude would be almost surely impossible, or at least extremely expensive.

WINNERS AND LOSERS OF ABATEMENT STRATEGIES

Abatement potentials and costs vary across geographic regions and economic sectors as well: "Although our research suggests the net cost of achieving […] GHG abatement could be quite low on a societal basis, issues of timing and allocation would likely lead various stakeholders to perceive the costs very differently."[103] GHG mitigation obviously will mean no big boost to oil and coal producers and consumers. Energy intensive industries like steel production and parts of the chemical sector will be faced with increasing costs, which in turn will make their products more expensive. But even in these sectors, there is a lot of potential for adjustment, whether through substance substitution, carbon sequestration, or efficiency technology. Furthermore, it is important to emphasize that unprevented climate change will itself affect the energy sector: decreasing water availability due to climate change will be followed by reduced hydropower potential in certain areas.[104] Nuclear energy needs massive amounts of water which might become scarce due to warming temperatures.

In 2006, Germany was the world's number one and the United States number three in terms of wind power capacity.[105] Apart from the renewable energy and energy efficiency technology sectors, probable winners of a "green revolution" will include the IT sector ("intelligent" grids and appliances are already the talk of the day in Silicon Valley), innovative companies working in the areas of chemical or biological products, and generally green tech entrepreneurs in all climate-relevant sectors. As the share of "green" industries in the overall GDP of a given political entity gets bigger, so too does their pressure on politicians increase to support their markets.

Since there is ultimately no rational alternative to prompt and ambitious action, those who act first will in all probability be rewarded for their early action. There are a number of "first-mover" or "pioneer" advantages.[106] Many companies are already shifting from being only part of the problem to becoming a part of the solution. The companies that have changed their mindset first and then changed their actions, and have included energy efficiency and climate-related objectives into their strategies, have had overwhelmingly good experiences. BP, Dupont, Lafarge, Shell, and many other former foes of the environmental movement, through a vast array of measures including new production standards, logistics changes, or company-internal emission trading, are seeing enormous cost savings while reducing both emissions and energy intensity. New green technologies and services now make up significant shares of their business and value generation. On top of these direct economic considerations are indirect advan-

tages like the motivation of strengthening consumer ties though green labeling.

We are already seeing major shifts in consumers' behaviors due to both a higher sensibility for climate change and high energy prices: Sales of SUVs and other gas-guzzling cars have plummeted while sales of high gas mileage vehicles have increased. Public transportation systems are overstretched like never before. People are planning vacations in their vicinities instead of jetting halfway around the globe. Local products are becoming comparably cheaper than those shipped from far away because of the fossil fuel crisis and are "politically correct" due to climate change. There can be no doubt that the manufacturers and service providers best prepared for a continuation of these trends will be the most profitable ones.

It is crystal clear that those in our societies and on a global scale who are already the underprivileged will suffer most from climate change and energy shortage. Hurricanes Katrina and Rita gave tragic examples of what extreme weather effects mean, in particular for the poor. It is also small-income families in Germany and the United States who suffer most from rising energy prices due to fossil fuel shortages. Likewise, on a global scale, poor countries will be hurt most from both climate change and energy insecurity. Almost all developing countries are situated in the tropic Torrid Zone most affected by the negative effects of global warming. They have the least capacities to adapt to changes. At the same time, their economies are more energy intense. Therefore they suffer relatively more from high energy prices than the developed countries.

Since the current market does not reflect the polluter-pays principle, we have to discuss how new market instruments can support the development of climate-friendly and secure energy production while at the same time abolishing some of the short-term hardships which might be a consequence of increased upfront costs. The increase in gasoline prices due to LWCSA is estimated to reach 13 percent by 2030.[107]To put that in perspective, gasoline prices have risen by 125 percent since January 2005. In the meantime, GHG reduction requirements would create economic incentives to decrease our consumption of oil which would directly reduce costs. It would also lower overall demand which in turn could reduce the price of energy significantly.[108]

On top of this, market instruments can be used to redistribute revenues. A cap-and-trade system can use returns from the auction of emission permits to "offset" any potential energy bill increases for low-income families. According to estimates, 14 percent of the revenues from emissions allowances could completely compensate the bottom fifth of the income spectrum for any increased energy costs.[109] In case of a $4 a gallon "price floor" for gasoline, anyone earning under a certain income could be compensated with a reduction in the payroll taxes. Since 1999, the German "eco tax" makes the consumption of energy ("the bad") more expensive while at the same time relieving the social security fund and thereby reducing the costs of employment ("the good").

COMPETITIVENESS AND NATIONAL CLIMATE LEGISLATION: THE ISSUE OF "LEAKAGE"

The issue of competitive disadvantage of countries acting on climate change toward those who do not plays a more prominent role in American than in German debates on climate and energy policy. In the United States, the argument that the nation would suffer economic disadvantages from GHG regulation if countries like China or India do not have the same limitations led to the 1997 Byrd-Hagel Resolution that expressed the consent of the Senate to never ratify an international treaty which would rule out such assumed economic injustice. This position was also taken by President Bush when he withdrew from the Kyoto Protocol in 2001.[110] As much as this view can be contested,[111] global trade competitiveness might stay at the heart of both international climate negations as well as the debate on domestic action.

The concept of "leakage" describes the problem that if a country takes on a domestic cap on GHG emissions, the goods and services generated in that country might become more expensive. Goods and services from unregulated countries might then be in a production cost advantage which in turn could force a migration of industry to countries with no constraints, where the costs of emissions can be avoided. As a result, the regulated country could lose jobs while there is little net reduction in global GHG emissions.[112] There are a number of important considerations regarding the issue of leakage. First of

all, the problem often seems to be exaggerated. Clearly, the higher labor and other costs in industrialized countries usually far outweigh the costs of paying a carbon price. Still, the advantage of location most often remains with the developed countries. Second, competitiveness is an immediate concern for energy intensive industries that compete globally, not necessarily for the economy as a whole. Studies of past U.S. environmental regulations do not find significant adverse impacts on economic competitiveness. Studies suggest that the leakage impact of a mandatory cap-and-trade system could be about a 2 percent decline in output in energy-intensive industries as a whole, with no perceivable effect on jobs. However, effects on individual industries and firms could vary considerably.[113]

But even if carbon leakage becomes a serious problem, there are ways to deal with it. The U.S. House of Representatives Committee on Energy and Commerce recently released a white paper which reviewed several policy options for addressing the issue of carbon leakage. The responses ranged from so-called border tax adjustments (i.e., new tariffs on the import of energy intensive products from countries without regulation) to other trade sanctions to a cap-and-trade program that would give incentives to non-regulating economies to take on their own caps. Another option discussed would require importers from non-regulating countries to buy emission allowances for the imported goods. This proposal brought forward by three leading trade unions (American Federation of Labor and Congress of Industrial Organizations, AFL-CIO; the Association of Electricity Producers, AEP; and the International Brotherhood of Electrical Workers, IBEW) anticipates the program to be so powerful that it would persuade large emitting countries to take on emissions reductions on their own.[114]

SHIFTING FROM COSTS TO OPPORTUNITIES

Recently, more and more commentators are not only demanding political efforts to reduce our consumption of fossil fuels and our climate footprint based on environmental and security considerations but, even most importantly, economic ones. Some of them see chances to break down the oligopoly-like structures of the main energy producers in our countries. Others simply see new markets like emissions trading as a new opportunity to earn money. Why should the slogan "trade is good" not count for this market? For the world's leading financial centers, emissions trading is simply a valuable new kind of product. Some estimates of the size of the global emissions trading market exceed $100 billion already by 2010 and €2 trillion by 2020.[115]

Yet other commentators from both sides of the Atlantic see a wise climate and energy policy as the foundation for long-term economic prosperity: As one American analyst puts it:

"A look back at America's economy over the past century shows that we have led the way in each major economic revolution, from mass production to semiconductors to the internet. Technological leadership drives our economy. A cap on carbon will spark innovation and allow American entrepreneurs to lead the world in the coming low-carbon economy."[116]

An EU advisor on climate and energy issues sees European industry well-equipped to lead:

"European industry has the scientific, technological, and financial know-how to […] lead the world into a new economic era. Europe's world class automotive industry, chemical industry, engineering industry, construction industry, software, computer and communication industries, and banking and insurance industries, give it a leg up in the race to the Third Industrial Revolution."[117]

Many important co-benefits of an energy revolution and mitigated climate change have already been mentioned. One of the most important ones, however, might be the creation of green collar jobs. A Third Industrial Revolution would require a wholesale reconfiguration of the transportation, construction, and electricity sectors. While the number of jobs that might be lost over the next twenty years due to an emissions cap is projected to be significantly lower than the jobs created and destroyed every three months in the manufacturing sector, the opportunities for creating new goods and services, spawning new businesses, and providing millions of new jobs in Germany and the U.S. seem to be immense. The booming market of renewable energy and energy efficiency industries supported a total of 8.5 million U.S. jobs in 2006.[118] Legislation like a rigorous GHG cap and trade system, feed-in-tariffs for renewables, and many other politically established market measures

can make efficiency and alternative energy sources even more economically attractive and spur further investments in this field. Another advantage is that many green collar jobs are bound either to high-tech work environments or to decentralized systems in local communities and therefore cannot be easily sent abroad.

Reducing GHG emissions and energy import dependency is as much an economic as it is an environmental and security policy. The list of those who want to "address the greatest moral and economic challenge of our time—climate change—and turn it into our greatest opportunity," who want to turn "Green to Gold" and "our greatest environmental crisis into our greatest economic opportunity," is long.[119] We better start using these opportunities if we want to avoid the grim economic and environmental scenarios of the future.

05

A NEW ERA?

A NEW ERA FOR TRANSATLANTIC COOPERATION ON ENERGY AND CLIMATE CHANGE?

Possibly with the exception of the Iraq War, climate change is the most prominent political rift that has occurred between Germany and the United States since the end of the Cold War. Climate and energy policy has become high politics, a symbol of the underlying disunity in the transatlantic partnership. However, new changes seem to be underway opening the doors for an enhanced, straightforward, and promising German-U.S. dialogue on this enormous challenge.

Looking at the Past: Same Interests, Different Positions[120]

Faced with the same challenges of climate change and a high dependency on fossil fuel imports, Germany and the United States in the past have answered these challenges in very different ways, both domestically and internationally. While Germany has been a model for other countries in terms of energy efficiency and considers itself "a pioneer in climate protection,"[121] the United States does not score too highly in either regard.

AN ACTUAL AND A FORMER ENVIRONMENTAL MODEL STATE

In the domestic realm, Germany has a number of programs and laws in place which work on both ends. It seems like the Federal Republic has drawn different lessons from the first oil crisis in the 1970s as well as the nuclear catastrophes and the awareness of a planet in danger in the 1980s. Since then, social, environmental, and economic sustainability aspects have become an important part of the political debate. As a result, the derivates of climate protection, higher energy efficiency, and a greater share for decentralized renewable energy systems have been incorporated in many actions of public authorities. They include mandatory laws, regulations, fiscal measures, support programs, and economic instruments. Important pillars are emissions trading; the "eco tax"; the Renewable Energy Sources Act, the Energy Conservation Act, and the Combined Heat Act; a reform of the Motor Vehicle Tax; different programs in the building sector; energy consumption labeling; and biofuel ordinances.[122] As a result, the German economy can be seen as a model. Since 1990, it has successfully decoupled economic growth, energy consumption, and GHG emissions. With GHG reductions at 18 percent in 2007, Germany has largely met its target of 21 percent for 2008-2012.[123] With these reductions, it shoulders a major share of the EU-15 countries' common Kyoto target of an 8 percent decrease. The country still has a long way to go to fulfill its ambitious future targets (see below), but without a doubt there have been important successes. Germany has not only become a leading exporter of environmental technology, but also of legislative provisions. Many of its laws and programs have been copied by other nations.

The United States needs approximately twice the amount of energy as Germany for the production of one dollar of GDP. Once, in the early 1970s, the country was at the forefront of environmental action, issuing a number of ambitious programs to tackle both pollution and energy scarcity. But as much as America can be seen as the birthplace of the environmental movement and an early model for other countries (e.g., the U.S. was the first nation to have a

national environmental plan and a specialized agency to watch over it), the record afterward has been rather mixed. There have been important successes such as the introduction of the catalytic converter and the 1990 Clean Air Act but these were rather isolated. Environmental policy passed through political ups and downs (George Bush '41 termed himself the "environmental president" and the topic was so important in 1988 that TIME magazine chose "The Endangered Planet" as Person of the Year), but they were most often an offshoot of human health policy aiming at reducing adverse substances in the air and water. The perils of a global energy, climate, and environmental crisis never pervaded the political discourse to the same extent as in Germany.

The U.S. Congress passed three Energy Policy Acts. Those of 1992 and 2005 included important provisions for conservation, such as the Energy Star program, but also much larger grants and tax incentives for non-renewable energy. However, in 2007, thirty years after President Jimmy Carter created the U.S. Department of Energy, the Energy Independence and Security Act was a big step in the right direction. The act consists of many different measures including massive funding for the improvement of the energy balance of buildings (which in the U.S. use more energy than transportation or industrial applications), the phasing-out of incandescent light bulbs, a solar air conditioning program, and the first increases of the average gas mileage (to 35 mpg by 2020) since 1975. In addition, a number of public-private partnerships have been administered by the U.S. government in order to reduce the high intensity of the U.S. economy (i.e., emissions per unit of GDP) by 18 percent until 2012. This, however, is roughly in line with business-as-usual efficiency gains and implies a further increase of absolute emissions by 11 percent (between 2002 and 2012 alone). Overall, voluntary programs, tax reductions, and government-funded R&D have been at the forefront of the Bush administration's climate policy.[124] At the time of writing, federal politics has not been able to establish any comprehensive domestic action on climate change. While the Bush White House did not intend to initiate any mandatory action, President Bill Clinton's attempts failed when he was faced with fierce opposition to mandatory action in the U.S. Congress. For the last two decades, U.S. climate policy has been mostly in a stalemate and shown very few results.

LEADER AND LAGGARD

In international climate policy, the picture is not much different. While the United States showed great leadership in the negotiation of the ozone regime in the later part of the 1980s, it has consistently been seen as the most potent laggard in UN climate negotiations ever since the early 1990s when the issue moved to the higher ranks of the international political agenda. In this area, the European Union has established itself as the indisputable leader. And within Europe, Germany has been one of the key players and consistently pushed for more ambitious action.[125] Most interestingly, Europe's leadership position had long been undermined by internal disagreements on important aspects of international climate governance. Only after the George W. Bush administration officially withdrew from the Kyoto Protocol, was the EU able to gain external capacity by concentrating on both internal policy cohesion and preparations for negotiations as a Union.[126] EU leadership has since been able to salvage the entry-into-force of the Kyoto Protocol in 2005 and the negotiations of a binding international regime to succeed this pact after its commitment phase ends in 2012. While these developments can be seen as an important emancipation process for the European side of the Atlantic, transatlantic divergences on climate and energy have also become something like a symbol of transatlantic disunity toward a wide array of global challenges which is disturbing to anybody committed to this long-lasting partnership as a precondition for solving these problems.[127]

Disturbed climate policy relations between Germany/Europe and the United States became widely visible with President Bush's repudiation of the Kyoto Protocol. However, these relations were contentious under the previous administrations of Clinton and George H. W. Bush as well. Since the beginning of international climate negotiations, the U.S. and Europe promoted different views about several aspects of climate policy, including: (1) the assessment of the state-of-the-art of science; (2) the necessity and magnitude of binding emissions reduction targets; (3) who should commit to such "targets and timetables"; and (4) the kinds of instruments and measures as well as their implementation.

First, until recently, important players in both the legislative and executive branches of the U.S. govern-

ment doubted the accuracy of international science on climate change. While Germany has taken the IPCC findings as guidelines for international and domestic mitigation goals, the Bush administration for a long time emphasized alleged deficiencies of the panel's work. A long list of reports exists that documents how the current administration tried to actively downplay the risks of climate change for the world and the U.S. itself; the certitude of human influence on global warming; and the effectiveness of anti-warming strategies.[128]

Second, while there has been no consensus in the U.S. that internationally binding emissions reductions are necessary, a broad cross-party consensus exists in much of Europe. In Germany, the Bundestag unanimously backed the Kyoto Protocol. By contrast, in the U.S., there have been majorities in the Senate, the House, and the executive branch that oppose the Kyoto Protocol or any other binding global architecture to control the dangers of climate change. The U.S. and Germany, as almost every other state in the world, ratified the 1992 United Nations Framework Convention on Climate Change (UNFCCC). The UNFCCC lays out the foundation and general principles of climate protection stating its ultimate objective as a "stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system."[129] Despite a number of voluntary cooperative efforts at the international level like the Asia Pacific Partnership on Clean Development and Climate and the Methane-to-Markets Partnership, the U.S. government still owes an explanation how it wants to reach this goal, in light of its high and rising emissions. With no additional measures put in place in the coming years, U.S. GHG emissions in 2012 are expected to be about 30 percent above the 1990 levels—and 37 percent above the U.S. Kyoto goal accepted by the Clinton administration but never ratified by the U.S. Senate.

Third, Germany has consistently supported the idea that mitigation should begin with the advanced industrialized countries while the U.S. has pushed for the inclusion of developing countries, most importantly China and India. The 1997 Byrd-Hagel Resolution, adopted half a year before the Kyoto negotiations, set the tone for ratification of any future international commitment on climate change. According to the resolution, the U.S. should not sign any treaty that a) does not "include commitments for countries with developing economies" or b) would "result in serious harm to the economy of the United States."[130]

Fourth, for a long time there have been strong differences in the preferred instruments for climate change mitigation. While Germany initially preferred "policy and measures" (i.e., direct regulation), the U.S. preferred market-driven systems such as emissions trading with which it had excellent experiences in reducing acid rain producing SO_2 emissions. It took Germany many years to support emissions trading as an important tool for cost-effective GHG reductions and Germany still believes in the necessity of additional direct interventions in the economy. By contrast, the U.S. relies exclusively on domestic and international R&D programs and voluntary emission cuts.

PUZZLING DIFFERENCES

The past climate and energy disagreements between Germany and the United States are puzzling because the two countries share similar interests. Earlier research has shown that the transatlantic gap cannot be explained with the instruments that traditional foreign policy analysis and international relations theory provide. The climate and energy divide also cannot be adequately explained with differences in material conditions. Different cost estimates are often cited as a reason why the U.S. abandoned Kyoto and the EU did not. However, cost assessments at the time of the Kyoto Protocol drafting in 1997, for example, were very similar for both actors.[131] In fact, Germany and the European Union have put in place a raft of policy measures with significant up-front costs despite the fact that the United States and most other trade competitors have not. This suggests that Germany has simply been more willing to take decisive action on GHG and energy intensity reductions despite facing similarly high material constraints as the United States. Likewise, differences in fundamental values cannot fully explain the divide between the U.S. and Germany even if the existence of an ideological divide is increasingly becoming conventional wisdom. Take uni- vs. multilateralism: Opinion polls in the United States do not show much support for the thesis that American public is unilateralist.[132] If, as a second example, Europeans are generally more concerned about the environment than Americans, why then did the green movement begin in the U.S. and keep inspiring Europeans in both envi-

ronmental policy and advocacy? In fact, a high number of polled Americans defined climate change as an important threat and a consistent majority of them supported mandatory action and binding international agreements.[133] Most Americans and Germans share the view that precautions to protect the climate are necessary despite up-front costs of action.

The clues, therefore, must be sought elsewhere than in general public attitudes.[134] In fact, a majority of the political elite in the United States showed a determined anti-Kyoto orientation and opposed domestic mandatory climate and energy regulation despite contrary views of the public. This resulted from certain groups and influences that are opposed to ambitious climate and energy action dominating the policy process and discourse in the United States over the last two decades. That this could happen is largely a result of U.S. political institutions. The separation of powers, voting rules, and campaign finance systems, among other institutional rules, shape which material interests and cultural values matter. In the United States, multiple actors hold veto power over policy. Unless an issue achieves overwhelming bipartisan support, America's sustained commitment to pursue new, progressive policies is often undermined, particularly if the proposed policies antagonize powerful interests.

The American political system guarantees both houses of Congress important rights of co-determination. The Senate can block international treaties and both chambers can block national policy implementation. In Germany, conversely, when the Chancellor has a majority of the members of Parliament supporting him or her, international treaty ratification and domestic legislation are often just a formality. In addition, the German electoral system has let the Green Party emerge as the third most powerful party, one that has been pushing consistently for higher environment and energy standards, both as a coalition member in government and from the opposition bench. The U.S. electoral system includes the capability of exercising leverage on legislators. While German campaigns are mostly publicly funded, American politicians are more dependent on sources of financing that have been hostile to climate change mitigation efforts.

In sum, our respective political systems allow different material interests and values to determine policy. When President Clinton pushed for strong action on climate change both domestically and internationally, he faced a reluctant U.S. Congress. In the last seven and a half years, Congress has been increasingly willing to act but encountered a White House opposed to mandatory action both at home and abroad. Elites largely shape our political discourse. To emphasize this point, U.S. elites in the past have shown little leadership toward the public on climate change and energy. From Richard Nixon's promise that a gallon of gas will never cost more than one dollar to Al Gore's proposal to tap the U.S. Strategic Petroleum Reserve in order to keep prices low, the provision of cheap energy has always been much more dominant in the U.S. political debate than the environmental effects and dependency aspects of those cheap prices. The result: With less than 5 percent of the world's population, Americans consume 26 percent of the world's energy and 25 percent of the world's petroleum production.[135]

A New Climate for Transatlantic Cooperation?

More recently, there have been important changes in the American debate on climate change and energy which dramatically raise the chances for the much-needed return of the United States to a leadership position on climate change and energy. Germany is anxiously awaiting the cooperation of its traditional partner on international issues.

STATE ACTION

In the absence of federal leadership, U.S. states have increasingly tried to fill the political vacuum on climate and energy. Already in 2002, eleven state attorney generals composed a public letter to President Bush in which they expressed their concerns, arguing for a more consistent climate policy from the White House in cooperation with the states.[136] The states have even tried to interfere with the national government's international policy. For example, California's Senate Joint Resolution 20 stresses the need for the U.S. to ratify the Kyoto Protocol. Initially, states such as California, New Jersey, and the New England states were at the forefront of pushing for climate policy coalitions in the United States. Recently, they have been followed by many others from all across the country.

In their Regional Greenhouse Gas Initiative (RGGI), ten northeastern states developed a GHG cap-and-trade scheme similar to that of the EU. California has expressed interest in joining the initiative and additional states are already participating as observers. The proposed program will require electric power generators in participating states to stabilize CO_2 emissions at current levels in 2009, and then reduce emissions 10 percent by 2019.[137] The Western Climate Initiative (WCI) is a regional initiative by states along the western rim of the United States and also includes some Canadian provinces, Indian nations, and Mexican states.[138] The stated purpose of the WCI is to identify, evaluate, and implement collective and cooperative strategies to reduce GHG emissions. On 22 August 2007, the WCI set a goal of reducing greenhouse gas emissions by 15 percent from 2005 levels by 2020. By August 2008 the partners will complete the design of a market-based mechanism to help achieve that reduction goal.

In the Western Governors Association's Clean and Diversified Energy Initiative, eighteen western states are encouraging the region "to utilize it's diverse resources to produce affordable, sustainable, and environmentally responsible energy."[139] Among other goals, the governors identified the necessary changes in state and federal policy to achieve a 20 percent increase in energy efficiency by 2020. The initiative has, more recently, led to the Midwestern Greenhouse Gas Accord, a regional agreement signed by six governors and the premier of the one Canadian province to establish targets and timetables for GHG reduction as well as develop a cap-and-trade system and, if necessary, additional measures such as a fuel standard and incentive mechanism to achieve these reduction goals.[140] Another regional initiative was started in the U.S. southwest.[141] As of December 2007, thirty-nine U.S. states had already signed on as charter members of The Climate Registry, a nonprofit organization created to develop a common system for recording, tracking, and publicly reporting the GHG emissions of businesses, municipalities, and other entities. The data will be used for voluntary, market-based, and regulatory climate initiatives including the regional efforts mentioned above, and efforts by individual states.[142]

California has been the most active state on climate and energy. The 2006 California Global Warming Solutions Act (Assembly Bill 32), "the first-in-the-world comprehensive program of regulatory and market mechanisms to achieve real, quantifiable, cost-effective reductions of GHG,"[143] aims at capping California's GHG emissions at 1990 levels by 2020. Furthermore, Governor Arnold Schwarzenegger has established a goal of reducing emissions to 80 percent below 1990 emission levels in 2050 (Gov. Executive Order S-3-05). Assembly Bill 1493 requires the state Air Resources Board to adopt GHG emission standards for light-duty vehicles. The standards will apply to the 2009 new model year if California receives a waiver from the federal EPA, which is currently contesting the state's primary jurisdiction in this area. Sixteen other states have already announced their intention to adopt the California tailpipe standards.

U.S. state action is important for a variety of reasons: First, states have significant levels of emissions even on a global scale. California, for example, emits more than Brazil, Texas more than France.[144] Second, states often function as "policy laboratories." Many, if not most, federal environmental regulations have been based on earlier action in states. States thereby create a sense of political momentum, a sentiment that climate change regulation is inevitable, thus increasing the likelihood of federal mandates. Finally, states have primary jurisdiction over such areas as power generation which are essential to addressing energy and climate change.[145]

On 29 October 2007, ten U.S. states partnered with Germany and eight additional European Union countries, as well as the European Commission, within the framework of the International Carbon Action Partnership (ICAP). ICAP is made up of countries and regions that have already or currently are implementing carbon markets through mandatory cap-and-trade systems. The partnership aims at providing a forum to share experiences and knowledge and to evaluate best practices.[146]

On top of state actions, many municipalities all across the U.S. have initiated ambitious climate and energy programs. For example, by May of 2007, 500 mayors had already signed the Mayors Climate Protection Agreement under which participating cities commit to (1) meet the U.S. Kyoto Protocol target of a 7 percent reduction of 1990 GHG emissions until 2008-2012 in their own communities through a variety of actions; (2) urge their state governments and the federal

government to enact policies to meet that target as well; and (3) urge the U.S. Congress to pass bipartisan GHG legislation which would establish a national emission trading system.[147]

The message from all these and other actions on the state and local level is clear: Pressure on the U.S. federal government to act much more determinedly on climate change, energy efficiency, and fossil-fuel reduction is growing immensely.

U.S. CONGRESS

In contrast to both Clinton terms, Congress during the Bush administration tried to initiate stronger climate policy measures, often thwarted by the White House. There have been an impressive number of climate policy initiatives in both houses of the U.S. Congress in recent years. One early prominent bill was introduced in the Senate on 8 January 2003 by Senators Joseph Lieberman (D-CT) and John McCain (R-AZ). Their Climate Stewardship Act includes a national cap on U.S. greenhouse gas emissions and trade of emission rights. The bill, however, was defeated in the Senate by 43 to 55. On the positive side, this result was better than even its proponents expected. Against a strong coalition of climate skeptics from the executive and legislative branches, key policymakers such as then-Senate Foreign Relations Committee Chair Richard Lugar changed sides and supported the bill. Still, a reintroduction of the bill in 2005 could not win a majority.

When the Democrats won control of both the House and the Senate in the 2006 elections, new House Speaker Nancy Pelosi (D-CA) and Senate Majority Leader Harry Reid (D-NV) declared climate change legislation a major priority for the 110th Congress. In early 2007, a special committee, headed by Rep. Ed Markey (D-MA) was founded. This Select Committee on Energy Independence and Global Warming has since conducted hearings on both issues. The committee has not had the authority to draft legislation on its own, but worked with those standing committees that have jurisdiction on recommendations for legislative proposals. Unfortunately, this constellation soon turned into an in-house power struggle with the likely result of a legislative stalemate in the 110th Congress. Rep. John Dingell (D-MI), the long-serving chairman of the powerful House Energy and Commerce Committee and a long-time ally of the automobile industry, opposed the installation of the Select Committee and soon made clear that House climate and energy legislation would only become reality with his committee's support. Largely ignoring Markey's panel, Dingell proposed legislation on his own. His plans would increase coal-fired and nuclear generation—albeit with "carbon sequestration," tax carbon usage, and enact vehicle emissions standards. However, carbon sequestration technology is not yet available at a large scale, nuclear energy is an anathema to most Democrats, a carbon tax is not acceptable to a majority in the House (those who want to see mandatory legislation mostly tend toward cap-and-trade), and his vehicle emissions standards would not yield any substantial GHG savings.

Meanwhile in the Senate, Senator Barbara Boxer (D-CA), the new chairman of the Environment and Public Works Committee, pushed for significant cap-and-trade legislation. Many Democrats soon gathered behind America's Climate Security Act of 2007 introduced by Sens. Joseph Lieberman (I-CT) and John Warner (R-VA). As discussed from an economic standpoint above, the "Lieberman-Warner Bill" would create a national cap-and-trade scheme. The cap would be tightened over time with the ultimate goal of reducing emissions to 63 percent below 2005 levels. On 5 December 2007, the Environment and Public Works Committee approved the legislation by a 11-8 vote and sent it to the Senate floor for consideration.

By April 2008, a political showdown occured between supporters of the Senate bill and supporters of the House bill; a showdown that, according to Dingell, would "involve some of the more ferocious infighting that we've ever seen."[148] On 6 June the bill received a 48-36 Senate vote, with bipartisan support, but fell twelve supporters short of the 60-vote threshold needed to overcome a GOP filibuster and move to final consideration. The defeat of the climate bill came after a vicious debate in which mostly Democratic supporters of the act accused Republicans of spreading misinformation including that it would damage the U.S. economy and further increase gas and energy prices.

At the time of writing, it seems to be more probable that the 110th Congress will not succeed in passing coherent, mandatory climate change and energy

legislation. Nevertheless, by 2008 climate change and energy security have become top issues for both the House and Senate. The Lieberman-Warner Climate Security Act is the first GHG cap-and-trade bill to be approved by a full Congressional committee. Since 2005, a Sense of the Senate Resolution has stated that human activities are a substantial cause of global warming, and furthermore that "Congress should enact a comprehensive and effective national program of mandatory market-based limits and incentives on emissions of greenhouse gases that slow, stop, and reverse the growth of such emissions."[149]

A NEW WHITE HOUSE

Over the course of his administration, President Bush has changed his approach to energy and climate policy. In 2007, he started his own international leadership initiative, a series of "Major Economies Meetings" which gathered high-ranking representatives of the world's top seventeen greenhouse gas emitting countries. The initiative, however, has shown limited success thus far, due mainly to the unclear need for such a new initiative. After all, there is already a G8+5 process on climate and energy in place, initiated 2005 by Tony Blair, and in 2007 put at the center of the German presidency, which gathered the top thirteen GHG emitters. For most analysts, the two Bush terms were lost years for climate and energy policy.

Thus, one of the most encouraging changes in the U.S. treatment of climate change and energy is still ahead of us: the change of the top White House personnel in January 2009. Both presidential candidates have made mandatory national action and a binding international agreement central to their climate change policies. Senator John McCain has been a key leader on the topic in the U.S. Senate for many years. He sponsored one of the most prominent emission trading bills introduced in the Senate: The McCain-Lieberman Climate Stewardship Act was a predecessor of the recently negotiated Warner-Lieberman bill. At a recent rally, the Republican presidential candidate called climate change a "test of foresight, of political courage, and of the unselfish concern that one generation owes to the next. […] The facts of global warming demand our urgent attention, especially in Washington. […] We need to think straight about the dangers ahead, and to meet the problem with all the resources of human ingenuity at our disposal. We Americans like to say that there is no problem we can't solve, however complicated, and no obstacle we cannot overcome if we meet it together. […] And now it is time for us to show those qualities once again."[150]

McCain's presidential platform calls for a cap-and-trade system to drastically reduce the country's GHG emissions. Specifically, McCain calls for a series of targets for reducing carbon emissions. The Senator wants to start with a goal of reducing emissions to 2005 levels by 2012, and then continuously decrease emissions to 60 percent below 1990 levels by the year 2050. In terms of efforts at the international level, McCain wants to reengage with the international community, including UN treaty negotiations. He believes that even "if the efforts to negotiate an international solution that includes China and India do not succeed, we still have an obligation to act."[151] The candidate wants to apply the same environmental standards to industries in China, India, and elsewhere that he wants to apply to U.S. industries:

"[I]f industrializing countries seek an economic advantage by evading those standards, I would work with the European Union and other like-minded governments that plan to address the global warming problem to develop effective diplomacy, effect a transfer of technology, or other means to engage those countries that decline to enact a similar cap."

Senator Barack Obama, the presumed Democratic presidential nominee, has called for an 80 percent reduction target below 1990 levels by 2050. This target is in line with the emission cuts scientists deem necessary for industrialized countries in order to halve global emissions by 2050, a probable prerequisite to stay below the 2°C benchmark. In addition to seeking the advice of former Vice President Al Gore, recipient of the Nobel Prize for his leadership on climate change, Obama appears to be so eager to act that he does not want to wait until elected: "I think we need to start reaching out to other countries ahead of time, not because I'm presumptuous, but because there's such a sense of urgency about this."[152]

Like his Republican opponent, Obama wants to create a national cap-and-trade system. His plan, however, foresees an auctioning of 100 percent of emission permits from the start, a policy favored by most environmentalists and cost analysts. The

Senator wants to spend the considerable amount of money raised through auctioning on energy R&D, "green job" programs for low-income workers, and a clean energy venture capital fund to move existing clean technology to the market.[153]

There are important differences between both presidential candidates. Obama proposed a renewable portfolio standard that would require 25 percent of U.S. electricity to come from renewables by 2025. He also wants to boost vehicle and building efficiency. And while both contenders want to increase federal spending on biofuels and "clean coal," McCain believes that nuclear power should play a major role in energy and climate solutions. Obama has not yet been very explicit on nuclear's role. Altogether, however, there can be no doubt that both presidential hopefuls would mean a major change to the White House's national and international stance on climate and energy. In particular, if coupled with a Democratic majority in Congress, it seems highly likely that the U.S. under both a President McCain and a President Obama will introduce strong domestic legislation and reengage vigorously at the international table.

INDUSTRY IS CHANGING COURSE

Among U.S. industry, too, there has been a notable shift over the course of the last years.[154] In the 1970s and 1980s a self-styled Global Climate Coalition (GCC) of predominantly American companies mutinied against any form of binding action to address environmental concerns and even challenged the scientific basis of climate change. Since the end of the 1990s, more and more members have left the GCC; in 2002, the association finally broke up. Today, some of these former opponents are among the largest supporters of national and international climate policies.

Several environmental organizations now have dialogues in place with some of the major players in the American industry. The forty-two members of the Business Environmental Leadership Council (BELC) include such diverse industries as chemicals, manufacturing, IT, oil, gas and transportation, and giants such as Boeing, Hewlett-Packard, and General Electrics, representing nearly $3 billion market capitalization and nearly four million employees. The BELC calls for ambitious national legislation in the U.S. and the strengthening of the Kyoto Protocol's market-based measures at the international level.[155] In another initiative, the U.S. Climate Action Partnership (USCAP), a group of leading environmental organizations (including PEW, Environmental Defense, The Nature Conservancy, and the World Resources Institute) teamed up with the "Who Is Who" of the American economy (Alcan, Caterpillar, Chrysler, ConocoPhillips, DuPont, Ford, General Motors, PepsiCo, and many more) to call on the U.S. government to quickly adopt legislation in order to reduce national GHG emissions.[156]

In the absence of federal legislation, most members of USCAP and BELC have committed themselves to, in some cases, very significant reduction goals. Dupont, one of the world's largest chemical companies, has already decreased its GHG emissions by 72 percent since 1990. Bank of America aims to reduce its GHG emissions by 90 percent between 2004 and 2009. Even operators of coal-fired power plants such as AEP want to drastically reduce their emissions. In addition to their initiation and advisory function, environmental organizations play an important role in these processes as they monitor the companies' compliance with their noble objectives. Besides measures in their own house, many enterprises, including medium-sized ones, offset emissions by investing in compensatory measures such as reforestation or renewable energy projects.

Even some of the long-time "black sheep," such as Exxon Mobil, have indicated a change of attitude in recent months. For years, the company sponsored climate skeptics with millions of dollars in donations. The sense of change in the American business community is not only important because of the technical know-how of the companies essential for a solution to the climate problem. It must also be seen against the structural condition indicated above that the impact of business on policy in the United States is disproportionately higher than in Germany and most other European countries.

There are at least five reasons for the change among U.S. industry. A first motive that should not be underestimated falls in the area of human resource policy. For corporations, it is undoubtedly easier to get good personnel on board when they are assumed to be good, responsible players acting "on the right side." Second, companies aim at making their products more attractive to ever more conscious consumers

through a green labeling of their products and their enterprise as a whole. Third, many players want in on the emergence of a new, gigantic market for climate-friendly and energy-efficient technologies. Fourth, most companies have begun to realize that many different regulations in the individual U.S. states and on the international stage are more expensive for them than a single market framework. And finally, a growing number of companies have awakened to the reality that it is only a matter of time before mandatory federal action will internalize the societal costs of climate change and fossil fuel reliance in their practices. They sense that it will be advantageous to be at the forefront of this process.

To be sure, there is still considerable resistance to ambitious climate action. Not surprisingly, at the forefront of organized business opposition are the heavy-polluters among the energy producers and consumers. But even these industry lobbyists had to shift their approach. In the words of Scott Segal, director of the Electric Reliability Coordinating Council which lobbies on behalf of power companies like Southern Co. and Duke Energy Corp, "you can't simply say no to everything. Instead you have to say thoughtfully what is the best way to reduce carbon cost-effectively."[157] For two decades, a majority of organized American companies used various channels to hamper a more progressive role of the United States in climate change policy. Now a majority of industry is beginning to want to become part of a solution, not only a major part of the problem. U.S. industry insofar follows the same path that most of German industry took a few years ago when it finally gave up opposition to Kyoto and EU-wide emissions trading.

Altogether, the changes in the U.S. Congress and among U.S. industry, the leadership of U.S. states, and the expected shift of White House policy under a new U.S. president are preparing the ground for a renewed German-U.S. partnership on energy and climate change. With regard to all major bones of contention in the past—the state-of-the-art of science, the necessity of binding emissions reduction goals, the kinds of instruments adequate to reach them, and the requirement of all international actors taking responsibility—the United States is currently in the process of rejoining international efforts to effectively tackle the challenge.

Stepping Stones of a Renewed German-U.S. Energy and Climate Partnership

The course of the German-U.S. partnership since the turn of the millennium is not only worrying but also difficult to understand: Not only does the continuous integration of the transatlantic economy call for a strong political foundation, but cooperation across the Atlantic will be essential if either side wants to tackle the increasingly global challenges of the future.[158] As the president of the Carnegie Endowment for International Peace Jessica Mathews notes, there is little in international politics that cannot be done if Americans and Europeans agree—but very little can be done if they do not.[159] Thus, such joint global tasks as climate change and energy security also carry the potential to become an opportunity to renew the Atlantic partnership.

There can be no doubt the U.S. will need to be on board with an international climate change agreement if the global community wants to prevent the Earth from a dangerous temperature increase of more than 2°C. The United States is by far the largest single emitter of GHGs in the industrialized world. It is also a potential leader in developing technologies to deal with the causes and effects of climate change. The country's political influence on a global stage is second to none; the German government has repeatedly made that clear. In the words of German Minster for the Environment Sigmar Gabriel: "The world knows that the time is ripe to negotiate an enhanced climate agreement. The U.S. is an important partner here. As the world's largest emitter of greenhouse gases, the U.S. must be on board in a follow-up agreement to the Kyoto Protocol."[160] But how could such a renewed German-U.S. partnership on climate change become reality?

STEP 1: OVERCOMING THE PAST

The German government should not and will not end its friendship with the U.S. government. Germans might appear reserved these days regarding a transatlantic climate partnership—but this has to be seen against the disappointments of the Bush administration for its European allies. First there was the big bang briefly after the inauguration of the new president when the U.S. unilaterally, without consultation with Europeans or any room for maneuver, declared Kyoto dead. Bush still announced an intention to have

"a leadership role on the issue of climate change"[161] but his national plan did not convince anyone serious about the problem. His emission intensity "yardstick" also came only weeks after Christie Whitman, then head of the U.S. Environmental Protection Agency, acting on National Security Advisor Condoleezza Rice's assurances, promised America's European allies that Bush would honor his 2000 presidential campaign pledge to set mandatory reduction targets for CO_2 emissions from power plants, which the program clearly did not.[162]

In Bush's first and second term, there were repeated attempts by the Europeans to open the door for meaningful participation by the U.S. in international climate policy, either within the UNFCCC or the G8+5 processes—but these doors have never been passed through. The administration talked about leadership on climate change and energy at the same time as denying any measurable commitments at home or abroad. Thus, when Bush revealed the "large emitters meetings" in 2007, skepticism was mixed with hope. Was this the big turning point in the president's approach? Had he, of all issue areas, picked climate and energy policy to demonstrate to future students of his legacy that he was able to hammer out a true global coalition against evil? Three large emitters meetings later we know that any such hopes were unjustified. Bush's goals, declared at the most recent meeting, include: no emission tax, no cap-and-trade, no patchwork of regulations, and no other mandatory domestic action either; likewise, no internationally binding commitments, instead promoting a continuation of voluntary programs in order to stabilize U.S. GHG emissions by 2025. In light of America's current emissions levels, Europe's given commitments of reducing GHGs by 20 percent by 2020—and even 30 percent should others accept similar goals—and the scale of necessary global reductions, Bush's leadership aspirations looked to the other delegations as a mockery. Gabriel called the president's remarks a "Neanderthal-speech" demonstrating "losership instead of leadership."[163] There has been a deep frustration with this administration in Germany and other European countries. The two components of Bush's policy, strong rhetoric and close-to-no-action, have left deep wounds. Many Europeans currently see better opportunities for making significant progress in a dialogue with the emerging countries, including China, than with the U.S.

Despite—or because of all this—a new U.S. president will be greeted with great enthusiasm in the German climate and energy community. The shift of emphasis in American climate and energy policy has been closely watched on the other side of the Atlantic and expectations for a new White House are high. Still, the new U.S. president will need a lot of fine feeling and charisma to play the two-level game of domestic and foreign policy with success: While he has to forge a coalition of proponents of climate action at home, he will also have to show real leadership by being able to accept international compromises. Germany and its European partners are firm in their determination to hammer out a UN agreement for post-2012 that fulfils certain requirements. These include clear and binding targets and timetables and the continuation of Kyoto's "flexible mechanisms." But there is also a lot of room for reconciliation where the president can show that he has set the mark. Europe is indeed very interested in partnering with the U.S. on convincing the big emitters among the emerging countries that they have to shoulder a bigger share of responsibilities—if not the same as the rich nations. If the key condition of clearly defined "targets and timetables" toward emission pathways that are in line with a <2°C target is not be fulfilled, then Germany will be determined to continue its international and domestic stance without the United States. Overcoming the past means seeking the opportunities of a new era while understanding the goals and constraints of both sides.

STEP 2: REDISCOVERING THE ROOTS OF TRANSATLANTIC CLIMATE AND ENERGY PARTNERSHIP AND CONSIDERING OUR JOINT INTERESTS

The U.S. and Germany should renew their partnership on climate and energy. In 2000, at the first German-U.S. High-level Dialogue on Climate Change at the Villa Borsig, Berlin, the then-U.S. Undersecretary of State Frank Loy and the German Ministers Joschka Fischer and Jürgen Trittin, in the name of their respective governments, agreed on intensified dialogue and cooperation in this issue area.[164] The consensus found at this meeting could serve as a starting point in a renewed bilateral partnership. Also, under the surface of highly politicized disagreement on climate over the last seven years, German-U.S. climate and energy relations on the working level have largely stayed intact. Here cooperation works a lot better

than often publicly perceived. The U.S. and Europe have held annual meetings on climate and energy in the last years. A number of helpful technology projects have been set up. The international climate community network is without doubt the densest over the Atlantic. The existing personal connections and content-related organizations should be used for any renewed transatlantic partnership efforts.

Germany and the United States share the same interests in almost all facets of the challenge: in terms of their respective vulnerability to the effects of climate change and their dependency on the imports of ever more expensive fossil fuels; regarding their capabilities to contribute to political and technological solutions; in that they will both profit politically if they manage to demonstrate leadership on this key challenge of the twenty-first century—after all, both countries' high per-capita emissions become inexcusable against their commitment to taking the lead in reductions in the UNFCCC more than fifteen years ago; in security terms because they will not be exempted from the effects of turmoil, chaos, and conflict which major energy shortages and climate change might cause in other world regions; economically if they succeed in taking the lead of an inevitable third industrial revolution; and finally, both know that in the long run there can be no alternative to measurable contributions also from the newly industrialized countries, and that the chances are much better if they act toward them in unity.

STEP 3: STARTING TO DEFINE AND DISCUSS THE MOST IMPORTANT ISSUES AND COALESCE THE PROGRESSIVE FORCES NOW

It was very important that the U.S. could be convinced to get on board with a new negotiation process for a post-Kyoto treaty in the final hours of the last UN conference in Bali in 2007. The U.S. delegation was very reluctant at first, receiving open boos from other participants. When the U.S. delegation announced in the tumultuous concluding hours of the conference that it could not support the final text, Papua New Guinea's negotiator interrupted by yelling: "If for some reason you are not willing to lead, leave it to the rest of us. Get out of the way."[165] The U.S. finally gave in to a revised version of the agreement. The new process that was started in Bali gives the new U.S. administration the most important stage to change the international course. Of course, the exact content and design of the future international climate pact would have to be a centerpiece of a German-U.S. debate on climate and energy. The time for seeking consensus, however, is short. Ten months after the inauguration of a new president on 20 January 2009, the international community wants to reach consensus at the 15th Conference of the Parties to the UNFCCC in Copenhagen. The debate, of course, is already underway among specialized circles but it would make a lot of sense to create a German-U.S. platform now for straightforward dialogue on climate change and our energy future. The decisions at stake are partially so highly specialized and partially so pervasive that we will need to connect the sharpest minds from a wide variety of professions.

There are a number of important components of a future treaty that have to be discussed. They include: The targets and timetables for the industrialized world; the contribution of emerging countries (e.g., absolute, relative, or sectoral targets; binding or semi-binding timetables);[166] the future of the "flexible mechanisms"; the significance of forest protection and the inclusion of other carbon-storing natural "sinks"; and the necessity of enlarged funding for adaptation measures in those countries that cannot afford them on their own. In addition to these immediate regime-related issues concerning the next reduction phase until 2020, there are a number of other important discussion subjects concerning global commitment to climate protection. One is the question of a long-term global target (e.g., a locking-up of a 2°C maximum temperature target and what this means in terms of a global concentration target of GHGs in the atmosphere). If such a global target could be defined, it could also serve as a basis for discussions about an allocation formula of all nations (e.g., converging from absolute targets to those based on a per-capita basis).

A bilateral commission for emission pathways could be set up which looks at different American and German emission pathways over the short, medium, and long term. Different experts should feed their specific expertise into such a "clearing-house for information." What are cost-efficient potentials of renewable energies under different fossil-fuel price scenarios? Where are the low-hanging fruits, the "no-regrets" measures ready to be exploited immediately in different areas from energy and fuel efficiency to readjustments of production patterns and trans-

portation practices? What, how, and at what costs and benefits can different sectors of our economies—buildings and households, energy production, industry, transportation—contribute? When it comes to specific areas of technology development, specialists should describe in a way that is understandable to policymakers and the public alike what is state-of-the-art and where exactly there is the need for further progress. This will help to define the hot spots for climate-friendly, non-fossil technology development. Where can R&D be left to the private sector, where is public start-up financing required? Where do we need state-funded basic research for long-term technological breakthroughs? Where can local or regional entities take care of these questions, where would it make sense to collaborate over the Atlantic in order to reduce costs?

The role of bioenergy as a partial solution to climate change and fossil fuel dependency has recently been doubted because of a high carbon footprint of certain biofuels and the possibility of a negative effect on global food prices. What are ways out of these dilemmas? More production of biofuels with a higher efficiency, e.g., those generated from sugar cane, which would have to be imported from other parts of the world. Bioenergy is more than biofuels; so what assessment can we give for, e.g., wood panels? What about second generation biofuels? If they are preferable from an environmental standpoint, how soon can we produce them at a substantial capacity? The different fossil resources need a real reality check as well: What is their future role? Is there really something like "clean coal," and if so, when will its employment become possible on a large scale? Is natural gas an intermediate solution and for how long? Where and to what degree can it substitute coal and oil?

Different emission pathways depend not only on the availability of better and new technologies in the future. Many types of equipment are already marketable, but still do not get employed. Why? Where is there simply a lack of knowledge on behalf of local decision-makers (mayors, transportation managers, company owners, house proprietors) that they exist and could become worthwhile investments? Where do we have to create markets for them and by what means? Can we agree on new industry standards in some areas where the more expensive but more climate-friendly alternatives need such a competitive betterment?

It seems more probable than not that the U.S., as the EU, will put a cap-and-trade system at the center of its climate policy. Since a transatlantic carbon market would yield cost advantages, how and by when can we generate it by linking our systems? How should this carbon market be structured in order to keep it open for the participation of third parties and an integration of the "flexible mechanisms"? What other market mechanisms should be employed besides carbon trading? What are our experiences with quota systems, different forms of taxation, or feed-in tariffs? Learning from experiences and best-practice exchange is very important for getting to the most environmentally and economically efficient solutions. There is no need to duplicate errors of the past that have been made at different levels of political organization.

Many experts on climate change and energy have long seen the need for a reform of our energy systems as a great opportunity for making our lives safer and more enjoyable while growing the economy. But these chances generated by a third industrial revolution have not been well communicated. We have to develop strategies to get the public, the information multipliers, and the key decision-makers on board of this giant enterprise which is both without alternatives and highly valuable from a range of perspectives. A number of great proposals for future action within different timeframes exist.[167] By discussing these different opportunities on a German-American platform, we will only learn and profit from our individual experiences, cross-fertilized knowledge generation, and joint assessments. After all, this is what a partnership is all about.

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AICGS

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

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