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Climate change policy in the European Union: examining the Emissions Trading System

Tabitha Marie Cale
Louisiana State University and Agricultural and Mechanical College

CLIMATE CHANGE POLICY IN THE EUROPEAN UNION: EXAMINING THE EMISSIONS TRADING SYSTEM

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Tabitha Cale
B.A., University of Florida, 2005
M.A., Louisiana State University, 2010
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Abstract

The European Union Emissions Trading System (EU ETS) is a cap-and-trade program regulating the carbon emissions of specific industrial facilities and is the EU's primary policy mechanism for complying with emissions reduction targets found in the Kyoto Protocol. This dissertation examines the overall effectiveness of the EU ETS and more specifically what factors explain why some member states are more successful at reducing their carbon emissions than others. OLS and logistic regression models are constructed as well as qualitative case studies of Sweden, Denmark, Portugal and Greece, to examine observed differences in emissions in all 27 EU member states from 2005-2010 The models include variables relating to the overall capacity of the state to reduce emissions as well as other institutional factors, including measures of corruption, public opinion, renewable energy production, domestic oil production, green party presence in the national government and European Parliament, cabinet ideology, length of EU membership, post-communism and how permits are allocated. The time period examined includes the entire trial phase as well as the first three years of the first commitment period of Kyoto. The factors that best explain success or failure to effectively reduce emissions in the EU may provide insight into how best to achieve future emissions reductions there as well as in other carbon emissions trading programs already implemented or being designed.

Chapter 1: Introduction

Climate Change as a Global Issue

Over the last two decades global climate change has become accepted as a serious environmental problem by a growing majority in the scientific community. According to the UN Intergovernmental Panel on Climate Change (IPCC), "Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice and rising global average sea level" (IPCC 2007, 30). There are both natural and anthropogenic factors that can contribute to global warming processes. However, there is much evidence that it is the exponential increase in human production greenhouse gases (GHGs)[1] starting in the industrial revolution that has most impacted the changing climactic system. Indicators that the climate is changing include sea level rise of 6.7 inches in the last century, increasing global surface temperatures since 1880, increasing ocean temperatures, the melting of the Antarctic and Greenland ice sheets, reduction in Arctic sea ice, shrinking glaciers in some parts of the world, increases in extreme events including record temperatures and intense rainfall, and ocean acidification.[2] The concentration of atmospheric CO_2 is also at the highest level it has ever been in the last 650,000 years and, given that the most current trend of increasing levels of CO_2 began in the industrial revolution, many see this as direct evidence that this current period of climate change has been due to anthropogenic activities.[3] As consensus in the scientific community has grown, so have the number of policies proposed and enacted by international organizations and individual states.

[1] Greenhouse gasses include water vapor, carbon dioxide, methane, ozone, nitrous oxide, and some fluorine gasses. Also, see http://www.epa.gov/climatechange/ghgemissions/gases.html
[2] See http://climate.nasa.gov/evidence/ and http://www.ipcc.ch/publications_and_data/publications_and_data_reports.shtml#.T-NGdPWaKSo
[3] See graph of atmospheric CO_2 over time here http://climate.nasa.gov/evidence/

History and Emergence of Climate Science. The greenhouse effect,[4] or how gases in the atmosphere can trap heat from solar energy, was first described in 1824 by a French scientist, Jean-Baptiste Fourier. In 1904 Svante Arrhenius, a Swedish scientist, discovered that increases in carbon dioxide in the atmosphere could lead to warming.[5] By the 1950s Roger Revelle, a geophysicist working as the director of Scripps Institute of Oceanography, demonstrated that human use of fossil fuels specifically had contributed to increased levels of CO_2 in the earth's atmosphere[6]. In the 1950s, Charles Keeling, a scientist also working at Scripps, was the first person to take direct measurements of atmospheric carbon. He discovered that levels of atmospheric CO_2 were increasing.[7]

Climate Change as a Growing Global Policy Concern. Climate change first started to gain widespread attention as a global issue in 1988 when James Hanson testified in the United States Congress that warming due to the greenhouse effect would become an increasing problem, and when the IPCC was established. In 1990, the IPCC released its First Assessment Report on climate change. The report was intended to be used to "assist policymakers and future negotiators in their respective tasks" and it also recommended that the report be given consideration by "every government as it cuts across different sectors in all countries." The report also reflected "the technical assessment of experts rather than government positions" (IPPC 1990, 51) and declared "We are certain of the following: There is a natural greenhouse effect which already keeps the earth warmer than it would otherwise be. Emissions resulting from human activities are substantially increasing the atmospheric concentrations of the

[4] See http://www.epa.gov/climatechange/science/causes.html#greenhouseeffect and http://climate.nasa.gov/causes/ for more information about the greenhouse effect.
[5] See http://earthobservatory.nasa.gov/Features/Arrhenius/
[6] See http://earthobservatory.nasa.gov/Features/Revelle/
[7] See http://www.pbs.org/newshour/indepth_coverage/science/globalwarming/timeline.html for a timeline of climate change science and policy

greenhouse gases: carbon dioxide, methane, chlorofluorocarbons (CFCs) and nitrous oxide. These increases will enhance the greenhouse effect, resulting on average in an additional warming of the Earth's surface" (IPCC 1990, 52). Thus far, there have been three other Assessment Reports, the Second in 1995, the Third in 2001, and the Fourth and most current in 2007.[8]

The Earth Summit was held in 1992 in Rio de Janeiro and one of the documents produced at this United Nations conference was the UN Framework Convention on Climate Change. The UNFCCC proved to be inadequate and in 1997 the Kyoto Protocol was adopted. The Kyoto Protocol established binding targets of emissions reductions to be made by those countries that signed and ratified the document. All member states of the European Union are parties to Kyoto and the European Union Emissions Trading System is the primary mechanism being utilized to meet their targets. The United States signed, but never ratified the Protocol.

Projected Consequences of Climate Change

Global Impacts. The IPCC reported in its Fourth Assessment Report on climate change that if emissions levels of GHGs continue at or above current levels changes in the earth's climate would be larger than the observed changes of the 20th century. The report also projected changes including:

> Warming greatest over land and at most high northern latitudes and least over Southern Ocean and parts of the North Atlantic Ocean, continuing recent observed trends. Contraction of snow cover area, increases in thaw depth over most permafrost regions and decrease in sea ice extent; in some projections using SERES scenarios, Arctic late-summer sea ice disappears almost entirely by the later part of the 21st century. Very likely increase in frequency of hot extremes, heat waves and heavy precipitation. Likely increase in tropical cyclone intensity; les confidence in global decrease of tropical cyclone numbers. Poleward shift of extra-tropical storm tracks with consequent changes in wind, precipitation and temperature patterns. Very likely precipitation increases in

[8] See http://www.ipcc.ch/publications_and_data/publications_and_data_reports.shtml#.T-NOm_WaKSp to access full versions of each IPCC assessment.

> high latitudes and likely decreases in most subtropical land regions, continuing observed recent trends.[9]

Projected Impacts in Europe. According to the European Environment Agency, Europe is already starting to experience the effects of anthropogenic climate change and by 2007 the average land temperature was 1.2 °C higher than pre-industrial levels. Temperatures are predicted to continue to increase in Europe this century between 1-5.5 °C with eastern and northern Europe experiencing the most warming in winter and south-western and Mediterranean Europe experiencing more pronounced warming in the summer. Future temperature changes in Europe based on projections from the Intergovernmental Panel on Climate Change are as follows:

> The annual average temperature for Europe is projected to increase by 1.0-5.5 °C (comparing 2080-2100 with the 1961-1990 average). This range takes into account the uncertainties in the future socio-economic development by including two of the IPCC-SRES scenarios…The warming is projected to be greatest over eastern Europe, Scandinavia and the Arctic in winter (December to February), and over south-western and Mediterranean Europe in Summer (June to August). (EEA 2008, 43)

The incidences of heat waves are also expected to increase, and are expected have the largest effect on Greece, the Iberian Peninsula, and central Europe. Precipitation patterns have also been changing. The EEA reported that between 1961 and 2006 northern Europe received an increase of between 10 and 40 percent in annual precipitation while in some parts of southern Europe precipitation has decreased up to 20 percent. Projections of future precipitation patterns expect this general pattern to continue, with increased annual precipitation in northern Europe, particularly in the winter, and a decrease in precipitation in southern Europe especially in the summer.

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[9] See http://www.ipcc.ch/publications_and_data/ar4/syr/en/spms3.html for full report on *Projected Climate Change and Its Impacts* from the Fourth IPCC Assessment.

Research Questions

Given the serious potential impact of climate change globally, and in Europe specifically this study examines the effectiveness of the European Union Emission Trading Scheme (EU ETS). The EU ETS is the world's first cap-and-trade program for CO_2 emissions and all member states in the European Union are using this policy mechanism as their primary tool to meet their Kyoto Protocol greenhouse gas emissions reduction targets. Since this is the first carbon emission trading program, and it is on a large, continental scale, the success or failure of the EU ETS could have a substantial impact on global climate and provide a model for future policies. The primary research question examined in this dissertation is: What factors explain the observed differences among different EU member states' abilities to reduce the amount of CO_2 emissions produced at facilities regulated under the EU ETS? The answers to this question may provide useful insights into success or failure to reduce emissions that could inform the design of other cap-and-trade programs, and insights into what types of states may be able to implement this type of system most effectively. In addition, if there are certain factors that seem to interfere with a country's ability to be successful in reducing their emissions using this particular policy mechanism, states with those characteristics may want to try to change those conditions or select a different policy tool.

Methods and Design of the Dissertation

Both quantitative and qualitative methods are utilized in this analysis. In chapter 4, utilizing an original dataset, two OLS regression models and two logit models are constructed to evaluate the influence of corruption, public opinion on climate change, renewable energy production, oil production, green party presence in government, cabinet ideology, length of EU membership, green party representation in the European Parliament, post-communism, per capita

GDP on levels of verified greenhouse gas emission per capita as well as meeting EU ETS emissions targets. Chapters 6 through 9 include qualitative case studies using structured focused comparison to examine four specific EU member states in greater detail; Sweden, Denmark, Portugal, and Greece. Chapter 5 outlines the methods used in the case analyses in greater detail.

Usefulness of the Comparative Perspective. Comparative environmental politics and policy is a relatively new and understudied area of political science and “the research literature is limited. Most of what we know about different countries’ environmental policies and outcomes is based on single-country descriptive studies” (McBeath and Rosenberg 2006, 14). There is much work that needs to be done to add to this young and growing body of literature. “As has been pointed out frequently, environmental problems tend to be global and transboundary by nature. As such, they challenge the capacity of nation-states to make and implement effective policy” (McBeath and Rosenberg 2006, 5). Climate change is clearly a global, transboundary issue where the problem, levels of greenhouse gases that are too high and increasing, affects a very large common-pool resource, the entire atmosphere. In addition, environmental problems faced in one state are likely to be present in others as well, and there is significant potential for policy learning and diffusion to intentionally occur if solutions have been proven to work in other or multiple contexts.

There is also a need for more information on how domestic factors may influence environmental policy success or failure. “Given the preoccupation of scholars, policy-makers and activists with globalization, it is not surprising that the bulk of the political science literature on world environmental politics comes from the sub-fields of international relations and international political economy. But what becomes clear in perusing this literature is the need for a better understanding of the roles of domestic social forces and the political structures of nation-

states” (McBeath and Rosenberg 2006, 6). McBeath and Rosenberg further argue that it is important to study environmental politics across countries the following way:

> We take the position that nation-states and their governments still matter for three reasons. First, they are the locus of decision-making for a wide range of economic, social, cultural and resource management policies that affect the global environment, National governments, then, are the prime targets of local, national and transnational environmental activism. Second, only national governments can decide whether to join or not join, cooperate or not cooperate with international environmental agreements, treaties and protocols. And finally, many of the differences we find among the environmental policies and situations of nation-states depend on domestic political variables, including ideology, regime type, political culture, state-society relations, and scientific and institutional capacity. (McBeath and Rosenberg 2006, 7)

Plan of the Dissertation. Chapter Two describes the emergence of the modern environmental movement to give perspective on the events that led to the creation of the current institutions and policies addressing environmental problems. The emergence of climate change as a global issue is also examined. Chapter Three describes the use of emissions trading as a policy mechanism to reduce pollutants and gives examples of how it has been used in the past. The creation and function of the European Union Emissions Trading Scheme is also examined in detail. Chapter Four looks at influences on climate change policy and emissions reductions both at the domestic and EU level and includes a statistical analysis of the influences on emissions reductions in EU member states. Chapters Five through Nine constitute the second half of the dissertation and provide a qualitative examination of the influences on emissions trends. Using four specific member states, Sweden, Denmark, Portugal, and Greece as examples, the case studies analyses examine the variables included in the statistical analysis in greater detail and in the context of other country specific factors. Finally, chapter Ten summarizes results and lessons from the statistical models, the case studies, and provides conclusions based on both the

qualitative and quantitative analyses. Limitations of the study and suggestions for future research are also included.

Chapter 2: Environmental and Climate Change Policy in Europe

Emergence of the Modern Environmental Movement

The origins of the modern environmental movement can be traced to the conservationists and preservationists of the 1800s and 1900s. Conservationism focused primarily on resource management practices with goals of utilizing and maintaining forests, wildlife, and soil in ways that would ensure their continued productiveness for human use. Gifford Pinchot, Chief of the Forest Service in the United States from 1898 to 1910, is often associated with early conservation ideas and practices. While forestry and forest management had been practiced in Europe, it was not until Pinchot helped found the discipline in the United States[10] that it began to merge with the new ideas of conservation. In an anecdote described in a 1937 article appearing in *Agricultural History*, Pinchot described how his thoughts on what would become the paradigm of conservation emerged:

> I was riding my old horse Jim in Rock Creek Park one day—I think it was in February 1907—when suddenly the idea that put stone on the end of the club occurred to me. The idea was that all these natural resources which we had been dealing with as though they were watertight compartments actually constituted one united problem. That problem was the use of the earth for the permanent good of man. We had been dealing with our continent piecemeal, and of course we were losing an immense amount of steam and effectiveness by acting as single scouts scattering our efforts—like using bird shot instead of a single ball to kill a bear—and not attacking the problem in a united battalion. The idea was so new that it did not even have a name. Of course it had to have a name. Our little inside group discussed it a great deal. Finally Overton Price suggested that we should call it 'conservation' and the President said 'O.K.' So we called it the conservation movement. (Pinchot 1937, 262)

Pinchot described what he saw as the three great purposes of conservation as follows:

> First: wisely to use, protect, preserve, and renew the natural resources of the earth. Second: to control the use of the natural resources and their products in the common interest, and to secure their distribution to the people at fair and reasonable charges for goods and services. Third: to see to it that the rights of the people to govern themselves

[10] Pinchot studied helped found the Yale School of Forestry, the first school in the US dedicated to the study of forestry. See http://environment.yale.edu/about/history/

> shall not be controlled by great monopolies through their power over natural resources. (Pinchot 1947, 506)

Competing with the anthropocentric resource management-based views of conservation was the paradigm of preservation. John Muir, founder of the Sierra Club, is among the most well-known preservationists. Preservationists, particularly Muir, argue that the natural world had incalculable spiritual and aesthetic values and that some places should be preserved in their entirety because they rival churches and temples as places of inspiration and spiritual renewal for humanity. This view of nature continues to influence environmental thought most strongly in the sub-discipline of deep ecology. Muir "recognized the necessity of the formal preservation of wild country if future generations were to have any left" and felt that "wild nature, he believed, provided the best 'conductor of divinity' because it was least associated with man's artificial constructs" (Nash 1967, 425). In the opening paragraph of Muir's 1901 book *Our National Parks*, He describes the virtues of preservation and its value to society:

> The tendency nowadays to wander in wilderness is delightful to see. Thousands of tired, nerve-shaken, over-civilized people are beginning to find out that going to the mountains is going home; that wilderness is a necessity; and that mountain parks and reservations are useful not only as fountains of timber and irrigating rivers, but as fountains of life. Awakening from the stupefying effects of the vice of over-industry and the deadly apathy of luxury, they are trying as best they can to mix and enrich their own little ongoings with those of Nature, and to get rid of rust and disease. (Muir 1901, xx)

These two views of the natural world began to blend and change with the emergence of ecology as a scientific discipline coupled with a growing realization that industrial chemicals could potentially have negative impacts on human as well as ecosystem health.

While the intellectual thought behind modern environmentalism is tied to the ideals of conservation and preservation, the modern pollutants affecting today's environment have origins in the Industrial Revolution. With it came not just concern about the potential disappearance of "wild" places to be appreciated for their natural beauty or the recreational opportunities they

provided, those places were now too being threatened by changes in air and water quality by the byproducts of ever expanding economies.

Chemicals including sodium carbonate, potassium carbonate, hydrogen chloride, calcium sulfide, hydrogen sulfide, sulfuric acid, and others, were released into the air and waterways in a largely unregulated way, eventually leading to problems visible enough to generate concern over their potential public health consequences. Increased burning of coal led to smog in some cities, particularly in London where it mixed with their naturally occurring fog. By the 1800's chemical-laden smog became increasingly problematic, even contributing to deaths. In 1873 there was a 40 percent increase in the death rate in London that was attributed to particularly noxious smog that year.[11] There was some early legislation in the United Kingdom designed to reduce the amount of air pollution including the Smoke Nuisance Abatement Act in 1853 and the Alkali Act in 1863, but major modern environmental protection measures would not be seen in Europe until a century later.

By the 1950s and 1960s it was becoming clear in both Europe and North America that industrial pollution was a growing concern to human and to the health of ecosystems.
In the United States in October 1948, smog from two factories killed twenty residents of Donora, Pennsylvania and left many more ill.[12] Water pollution was becoming increasingly severe in the Great Lakes region and some waterways were so polluted that they even caught fire. Probably the most infamous being the Cuyahoga River which caught on fire multiple times including in 1868, 1883, 1887, 1912, 1922, 1936, 1941, 1948, 1952, and 1969 (Kehoe 1997).

"The long history of economic activity in Europe has given rise to problems of air, soil and water which were more severe than those of the US. Scientific evidence pointed to the

[11] See http://www.metoffice.gov.uk/education/teens/case-studies/great-smog
[12] See http://pabook.libraries.psu.edu/palitmap/DonoraSmog.html

worsening of these problems during the 1950s and 1960s as a result of the rapid growth and reconstruction of the European economies which took place following the Second World War" (Barnes and Barnes 1999, 26). In Europe smog was still a significant issue, and acid rain was beginning to cause noticeable damage in Sweden in particular. London's "Killer Fog" of December 1952 lasted for four days that year, led to the deaths of approximately 4000 people, and left many more with chronic breathing problems.[13] In Sweden the impact of acid rain began to increase and scientists found "between1962 and 1996 the wind-borne pollutants had increased the acidity of rainfall by a factor of eight" (Barnes and Barnes 1999, 26). This increase in the acidity of rain was particularly problematic because Swedish soil is low in calcium and therefore the "ecosystem was particularly sensitive to acidification, with much damage being done to forests, lakes and rivers" (26). While the Swedish government took action to reduce the domestic sources of sulphur dioxide and nitrogen oxides that contributed to acid rain, the problem remained unsolved because the sources of these pollutants were not solely in Sweden. Due to wind patterns, pollutants from the UK, Germany and Poland were creating transboundary pollution problems for Sweden in the form of acid rain (27). Similarly, pollutants generated in the United States lead to acid rain in Canada leading to a transboundary pollution problem that could not be solved without the cooperation of both states.

Pollution was becoming a more visible problem, and knowledge of its impacts was within the scientific community as well as among the general public. The amount of chemicals being developed and used commercially began to increase dramatically. "In 1947, the United States produced 124,259,000 pounds of chemical pesticides. Few people questioned the use of such deadly chemicals or their effect on the environment, and by 1960 the country was producing

[13] See http://www.metoffice.gov.uk/education/teens/case-studies/great-smog and http://www.epa.gov/aboutepa/history/topics/perspect/london.html

637,666,000 pounds of DDT potent pesticides" (Klein 2011, 81). It was not until 1962, with the publication of Rachel Carson's *Silent Spring*, that the general public became aware of the potential negative impact of the increased use of industrial chemicals. She described the potential problems of approving the use of new chemicals with unstudied effects in a tone that was urgent and in a style that was accessible to a general non-academic audience:

> The chemicals to which life is asked to make its adjustment are no longer merely the calcium and silica and copper and all the rest of the minerals washed out of the rocks and carried into the rivers to the sea; they are the synthetic creations of man's inventive mind, brewed in his laboratories, and having no counterparts in nature. To adjust to these chemicals would require time on the scale that is nature's; it would require not merely the years of a man's life but the life of generations. And even this, were it by some miracle possible, would be futile, for the new chemicals come from our laboratories in an endless stream; almost five hundred annually find their way into actual use in the United States alone. The figure is staggering and its implications are not easily grasped—500 new chemicals to which the bodies of men and animals are required to somehow adapt each year, chemicals totally outside of the limits of biologic experience. (Carson 1962, 7)

Carson described in detail how DDT accumulates in the food chain and causes long-term ecological problems. Carson also warned of the potential problems associated with reduction in biodiversity:

> Single-crop farming does not take advantage of the principles by which nature works; it is agriculture as an engineer might conceive it to be. Nature has introduced great variety into the landscape, but man has displayed a passion for simplifying it. Thus he undoes the built-in checks and balances by which nature holds the species within bounds. One important natural check is a limit on the amount of suitable habitat for each species. Obviously then, an insect that lives on wheat can build up its population to much higher levels on a farm devoted to wheat than one in which wheat is intermingled with other crops to which the insect is not adapted. (Carson 1962, 10)

Silent Spring represents a significant break with the past traditions of conservation and preservation by showing how these newer concerns were much border than those of conservation. "Environmental problems tended to be (a) more complex in origin, often stemming from new technologies; (b) have delayed, complex, and difficult to detect effects; and (c) have consequences for human health and well-being as well as for the natural environment" (Dunlap

and Mertig 1992). Carson's work also had a substantive impact on policy when first, "individual states gradually banned DDT use, and in 1972 the federal government followed suit" (Klein 2011, 84).

Seeing and Solving the "Tragedy"

In the late 1960s and early 1970s growing concerns about the consumption of natural resources combined with concerns about population growth, eventually leading to the concept and paradigm of sustainable development. In 1968, Garrett Hardin's famous essay "The Tragedy of the Commons" appeared in the journal *Science*. Through the metaphor of a "pasture open to all", Hardin described some of the fundamental difficulties that arise when managing common pool resources like environmental goods. He suggested that behavior that is rational for one individual in the short-term is irrational for all users of that resource over the long-term and warned that "freedom in a commons brings ruin to all" (162). In 1971 Paul Ehrlich and John Holdren published another influential article in Science, one warning of the impacts of exponential population growth. In 1972 a study of the long-term consequences and causes of population growth was commissioned by a group known as the Club of Rome (Barnes and Barnes 1999). In 1974 Ehrlich and Holdren published an even more influential paper in *American Scientist* presenting the IPAT equation. They suggested that the relationship between human populations, development, and the environment could be calculated and that the addition of each additional person to the earth was a product of the average affluence of the community in which they would live and the technology available to offset the resources they would consume where Impact = Population x Affluence x Technology.

Environmentalism as a Social Movement and Institutionalization

Focusing events like the Killer Fog, combined with increasing knowledge about ecology, the impact of industrial chemicals, concern over population growth and limited resources all led to a growing social movement in North America and Europe. It culminated with the creation of new legislation to reduce pollution and new institutions to enforce those laws. Concerns were growing not just in intellectual and academic communities but also among the general public. Public opinion surveys showed increasing levels of concern about environmental issues in the United States and between 1965 and 1970 responses indicating that "reducing pollution of air and water as one of the three problems to which they wanted the government to pay more attention" jumped from "17 to 53 percent" and this "increased attention to the environment culminated in the first Earth Day celebration on April 22, 1970. Some 20 million Americans took part" (Klein 2011, 90). At the same time new institutions were being created in the US and Europe to deal with environmental problems. In 1967 the Swedish Environmental Protection Agency was created, in 1970 the US Environmental Protection agency was established, and in 1971 Denmark created a Ministry for Pollution Control. The European Community (forerunner of the EU) also made environmental issues a higher priority in the 1970s and 1980s and established an Environmental Action Programme in 1972. In 1981 it established a Directorate General for environment. By 1994 an EU-wide environmental institution, the European Environment Agency, had been established. New nongovernmental environmental organizations such as the League of Conservation Voters also sprung up; to this day it provides information to voters on US members of congress' voting records on environmental issues illustrating that "by the 1970s, the environmental movement had matured and begun to effectively promote its cause" (Klein 2011, 91).

Parties with specifically pro-environment agendas, so-called green parties, were also being established and were beginning to influence in politics and policy-making. In 1972 a green party called Values was established in New Zealand and in 1973 a green party was established in the United Kingdom. In 1979 Daniel Brélaz was elected to the national parliament in Switzerland, becoming the first member of a green party to win a seat in an election (Klein 2011).

Climate Policy in the European Union

Climate change first started to gain widespread attention as a global issue in 1988 when James Hanson testified before the United States Senate Energy and Natural Resources Committee that warming due to the greenhouse effect would become an increasing problem, and when the Intergovernmental Panel on Climate Change was established. The 1992 Earth Summit held in Rio de Janeiro marked the beginning of the international response to climate change. At the Rio Summit the UN Framework Convention on Climate Change established voluntary emissions reductions targets for its signatories. In 1997, partially in response to the minimal progress made toward meeting the voluntary standards set in 1992, the Kyoto Protocol was negotiated to set more stringent emissions targets. The EU has been actively pursuing Kyoto-based policies and “As early as 1990, the EU voluntarily committed to stabilizing its emissions of CO_2 at the 1990 level by 2000” (EC Environment Fact Sheet, 3) and was successful in meeting those initial targets. The 15 countries that were EU member states at the time Kyoto was negotiated have committed to “to cutting off their combined emissions of the greenhouse gases controlled by the Protocol to 8% below the 1990 level by 2012. This overall target has been translated into a specific legally binding target for each member state based on its capacity to curb emissions. Most of the 10 countries that joined the EU in 2004 also have reduction targets

of 6-8%" (EC Environment Fact Sheet 2005, 3). To facilitate meeting these targets, the European Climate Change Programme (ECCP) was established by the commission in 2000.

The EU 15 signed and ratified the Kyoto Protocol which went into effect on February 16, 2005, and committed the participating countries to reducing their collective greenhouse gas emissions (GHG) by 8 percent. In order to meet these targets, the creation of a European market for carbon emissions trading was proposed in 2001 by the ECCP and on October 13, 2003 was formally adopted by the European Council and the Parliament, creating the European Union Emissions Trading Scheme (EU ETS). The EU ETS regulates the emissions of over 10,000 specific facilities that are point source emitters of GHGs. These installations include oil refineries, combustion plants, iron and steel plants, coke ovens, and factories producing cement, glass, lime, brick, ceramics, pulp and paper. The legal framework of the EU ETS does not explicitly outline how or where allowance trading takes place, so individual companies can trade allowances through a broker, bank or directly with each other.

Individual member states are responsible for producing National Allocation Plans (NAP) that establish the total amounts of CO_2 emissions allowances that will be allocated, and available for trade within the state. The Commission must then assess the country's NAP to ensure that the Plan will facilitate the meeting of the emissions reduction goals established for the state, and that the NAP is not in violation of the EU Treaty. Each individual member state is also required to establish a National Registry, through which records of all transactions involving the buying and selling of emissions permits, as well as records of the total amount of emissions produced by each regulated installation are kept. The information from each individual registry is then combined into the Community Independent Transaction Log (CITL), which compiles data for all

emissions trading activities in all 27 member states as well as activities in Iceland, Liechtenstein, and Norway.

The European Environment Agency (EEA) is responsible for compiling and verifying GHG emissions of EU member states, compiling the data into an annual GHG emissions report that is then submitted to the United Nations Framework Convention on Climate Change. The EEA is also responsible for monitoring member states' overall progress towards Kyoto GHG reduction targets.

Some early examinations of the effectiveness of implementation and compliance of EU environmental policies yielded disappointing results. Krislov et al. found that there was a "growing problem of compliance" across multiple areas of EU law. A 1992 report of the EU's Court of Auditors found that implementation of environmental directives was slow, and that a "significant gap between the set of rules in force and their actual application" existed (1986, 68). Bourzel (2000) found "considerable variation, not only between states but also between different policies within one state" (158) and that some states exceed EU environmental regulations, while others are unable to meet them. Jordan's (1998) findings also illustrated variation in member states' implementation and compliance with environmental regulations. Haigh (1999) and Sbragia (1999), however, suggest that implementation and compliance may not be as large of a problem in regard to climate change policies, but in order "To pass the test with confidence both 'implementation' and 'integration' will have to be taken more seriously" (Haigh 1999, 111). This indeed does seem to be the case; especially when considering that in 2007 the European Commission established new guidelines for monitoring and reporting GHG emissions. These guidelines were designed to improve regulation and compliance in the EU-ETS. These new regulations took effect January 1, 2008. Another potential difficulty that the EU-ETS could face

is variation in member states capacity to track and report GHG emissions accurately. The Community Independent Transaction Log is intended to provide “standards to ensure compatibility of the national systems with one another and with the European policies” (Voβ 207, 339) and the European Environment Agency is responsible for compiling and verifying GHG emissions of EU member states. It is difficult to say if these measures have done enough to ensure reliability in reporting emissions.

Overall, considering that 2005-2007 was intended to be a trial period designed to “develop the infrastructure and to provide the experience to enable the successful use of a cap-and-trade system to limit European GHG emissions in 2008-12 and beyond” (Ellerman and Joskow 2008, 45), the EU-ETS appears to be very successful. As of 2006, France, Greece, Sweden, UK, Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Poland, Romania, and Slovakia had already met their Kyoto emissions targets (see Table 1). The only countries that were then projected to miss their Kyoto targets were Denmark, Italy and Spain. Within a relatively short period of time, “the EU ETS has evolved from being an engaging possibility in the 2000 Green Paper (EC, 2000) to being what is now regularly characterized as the flagship of the European Climate Change Program” (Ellerman and Joskow 2008, 45).

Chapter 3: Emissions Trading as an Environmental Policy Mechanism

Environmental Policy Mechanism Selection

Environmental policies can impose economic and costs on governments, businesses and individual citizens, and can also impose political costs on those who support such policies and regulations. Often, it can be difficult to convince actors that environmental protection is in their best interest, and when actors are certain that it is not in their best interest, it can be especially difficult to obtain their compliance or cooperation with a particular policy. Environmentalists face many challenges when constructing and implementing policies to meet their goals including how to overcome Hardin's "tragedy of the commons," how to place price on the benefits of good environmental quality as well as the price of the negative impacts of pollution, and how to surmount the short-term bias in the policy making-process.

In his 1968 essay, Garrett Hardin outlines one of the most fundamental difficulties facing those who manage common pool resources, including natural resources. Using the example of a "pasture open to all," Hardin suggest that behavior that is rational for one individual in the short term, is irrational for all users of that resource over the long-term. In his example, a herdsman will ask "what is the utility to *me* to add one more animal to my herd" and thus, each herdsman will continue to add animals to their individual herds, until the pasture is so over grazed that it becomes useless to all. Williams (1999) also discusses the difficulty of managing common pool resources, focusing specifically on air. Williams argues that since air is a public good, it is especially difficult for the market to provide sufficient mechanisms and incentives to prevent its pollution. Therefore, Williams suggests, the government may be better equipped to regulate air quality, but may also face pressures from business interests and some voters to reduce levels of regulation, especially when those groups are incurring the costs of the regulation through taxes.

An additional difficulty that policy makers face when justifying the adoption of environmental policies comes in the form of how to accurately calculate the costs and benefits of a given policy. How does one go about quantifying what clean air or clean water is worth or how much the negative impact of polluted water would cost? Pareto (1920) argues that a change is efficient if it leads to at least one individual being better off, and no single individual being left worse off. While Pareto efficiency may be impossible to meet, the alternative criterion proposed by Kaldor (1939) and Hicks (1939) may be more attainable. The Kaldor-Hicks criterion proposes that changes can be defined as welfare improving if the individuals who gain from a particular change could potentially compensate individuals who lose for the full costs that they incur from that change. This is seen as efficient if, once the winners have compensated the losers, at least one winner is still better off because of the change. In short, the social costs of the change should be smaller than its social benefits. These two theoretical criteria are perhaps more easily applied when the costs and benefits of an action can be easily calculated, but calculating the costs and benefits of environmental policies can be particularly difficult because there is often disagreement over how much good environmental quality and its benefits are worth, both in the present and future.

Revesz and Stavins (2004) examine several potential methods for calculating values for these costs and benefits, including the methods of contingent averting behavior, hedonic pricing, travel-cost models, contingent valuation, and societal revealed preferences. Beyond the basic desire for a policy's social benefits exceeding its social costs, many authors have developed criteria to be utilized when selecting policies. Goulder and Parry (2008) argue that environmental policies should be cost effective, exhibit distributional equity of program costs and benefits, minimize risk despite uncertainty of costs and benefits, and be politically feasible to adopt and

implement. Revesz and Stavins (2004) argue that the policy instrument selected should also be able to meet the goal or standard being proposed, establish a reporting process that provide the government with any information it needs, encourage and provide for research that could improve pollution abatement, and adapt to using any new, more efficient technologies that emerge. The United States Congressional Office of Technology Assessment also recommends that policies chosen should place a minimal burden on government, be adaptable to local contexts, prevent pollution from occurring when possible, and consider environmental justice issues.

While these criteria are helpful, it is rare that each and every one will be met in a democratic system. Interest groups that represent industry and those that represent environmental groups often have different policy preferences. Some groups may be overrepresented in the political process, while others are underrepresented. This can be due to differences in the financial resources they have available, or due to collective action dilemmas. In addition, policy makers have their own sets of policy preferences and goals that may differ from what their constituents would prefer. Fenno (1973) argues that legislator's have three primary goals: reelection, maximizing their power within the chamber, and crafting good public policy. Mayhew (1974) argues that reelection is a representatives primary concern and that they cannot achieve secondary goals like maximizing power within the chamber and crafting good public policy unless they are first reelected. Policy makers are also dealing with incomplete and imperfect information and may not be able to maximize all of the above criteria simply because they do not have the information that would let them know which policy would be most cost effective or best minimize risk. Institutional effects may also inhibit or enhance policy making in a democratic setting. The United States Army Corps of Engineers is still frequently criticized for

having too strict of a bureaucratic culture that tends to ignore the needs and benefits of healthy ecosystems

Kingdon (1989) argues that environmental policy creation is contingent upon the flow and timing of events. This is counter to Easton's (1965) model of policy creation which views the policy-making process as a system of distinct steps where inputs feed in to government decision making and a policy is then created. Kingdon suggests that before a policy can be adopted and implemented three "policy streams"—problem, policy, and political—should converge. The policy stream consists of identification of a policy or mechanism to address the problem. The politics stream consists of enough political concern over the problem, and the political feasibility of the adoption and implementation of the policy that can fix it. Kingdon argues that it is not always necessary for all three streams to converge, but at least two must, and the best policy making occurs when all three converge.

Types of Environmental Policy Instruments

There are two primary types of environmental policy instruments; market-based, and command-and-control. Command-and-control policies are those where regulations are established by a central government, or government agency, and polluters are then forced to meet those established requirements. Revesz and Stavins (2004) argue that these types of policies are too inflexible, that they impose a similar burden of pollution control across all firms, regardless of costs, and that they can lead to significant inefficiencies (where costs of reducing pollution are higher than they would be if market-based incentives were utilized instead). Command-and-control regulations can also be technology forcing, requiring that all polluters to adopt the same technological means for reducing levels of pollution. An example of this would be requiring facilities to install pollution scrubbers. This type of technology forcing can be a problem since it

does not allow firms any flexibility in the way in which they reduce emissions, and since it does not allow for the creation or use of new technologies that might work better and or be more cost effective. Another major limitation of command-and-control policies is that they often ignore the differences in local contexts, both in terms of socio-economic factors and in terms of differences in the natural environment where they are being implemented.

According to Revesz and Stavins (2004), market-based policy instruments are designed to "harness market forces" and create financial incentives for firms to reduce emissions, or to alter consumer demand so that it leads to changes that reduce emissions. The idea of pollution charges was first developed by Pigou (1920) who argued that polluters should be forced to "internalize" the full cost of their emissions, and proposed that it should take the form of a tax on emitters. Revesz and Stavins (2004) claim that the closest example to a true Pigovian tax that has been used in the US is the unit-charge used in some jurisdictions on the disposal of household solid waste. This has also been referred to as a "pay-as-you-throw" program. Market friction reduction policies are designed either to create markets that did not previously exist, or to enhance the functioning of markets and allow the invisible hand to work unhindered. Examples of market friction reduction include information and product labeling policies (like the US EPA's Energy Star Program) that are designed to provide more information to consumers and alter consumer demand patterns. Government subsidies are, to Revesz and Stavins (2004) the mirror image of taxes, and can encourage entry into the market, and increase firms profit levels. The authors also argue that while subsidies can encourage growth in new, potentially environmentally friendly areas (like solar and wind power), they more often than not lead to inefficiencies that can also cause environmental harm. The authors generally do not recommend their use, and suggest that subsidy reductions can lead to environmental benefits. An example of

this would be lowering the subsidies on domestic production of fossil fuels which Revesz and Stavins argue could lead to significant reductions in CO_2 emissions in the United States. Liability rules force firms to pay for the negative impact of the pollution they create. An example of their retroactive use can be seen in the case of Exxon being held liable and forced to pay for damages caused by the Exxon Valdez oil spill in Prince William Sound. In that case contingent valuation was used to help calculate the costs that should be paid.

Emissions Trading as an Environmental Policy Mechanism

Several authors, including Coase (1960), Dales (1968), and Montgomery (1972), have proposed theoretical arguments for creating "markets" to manage pollutants as a viable policy option for abatement. Relying on this early theoretical work, the US Environmental Protection Agency was one of the first government agencies in the world to utilize this new type of policy tool and designed several programs based on creating markets for specific pollutants. The United States Acid Rain Program, the Regional Clean Air Incentives Market, and the NOx Budget Program all included emissions trading schemes as mechanisms for reducing sulfur dioxide and nitrogen oxides. These programs were seen as successful in achieving desired emissions reductions while being more cost effective than other abatement mechanisms. Voß argues that the US Acid Rain Program is an extremely successful example of how well trade-able permit systems can work and a 2005 report by the Pew Center for Global Climate Change argued that well-designed trade-able permits systems can lower the costs of pollution abatement by up to 50 percent. According to Revesz and Stavins (2004), emissions-trading is the most commonly used market-based system for pollution control in the US.

Emissions-trading allows firms more flexibility in how they choose to meet their targets, rather than imposing predetermined technologies or standards as a command-and-control would.

Polluters who are able to reduce their emissions to levels lower than their targets can sell their excess emissions to others who are not in compliance. Polluters who generate more emissions than allowed are forced to pay for excess emissions, creating an economically efficient solution (Pew 2005). The findings of Baron and Plilibert (2005), Tietenberg (1985) and Dales (1968), also suggest that emissions trading is the most cost-effective way of controlling emissions, regardless of the level of reductions to be enforced.

The European Union Emissions Trading System. The European Union Emissions Trading System (EU ETS) was proposed in 2001 and on October 13, 2003 was formally adopted by the European Council and the Parliament. The EU ETS first phase began on January 1, 2005, and became the first cap-and-trade system in the world to regulate carbon dioxide. The EU ETS regulates the CO_2 emissions of over 11,500 specific facilities across the EU. The facilities included in the program represent nearly half of the EU's CO_2 emissions[14] and include oil refineries, iron and steel plants, combustion plants, coke ovens, and factories that produce cement, glass, lime, brick, ceramics, paper, and pulp. All 27 member states participate in the EU ETS and are responsible for producing National Allocation Plans that establish within each state the total amounts of emissions that will be allocated, and available for trade. This study will examine the EU-ETS across two different units of analysis: the EU level, and the member-state level. This will facilitate comparison of the EU ETS to other GHG cap-and-trade programs, as well as facilitate comparison across EU member states.

[14] See: http://europa.eu/rapid/pressReleasesAction.do?reference=MEMO/05/84&format=HTML&aged=1&language=EN&guiLanguage=en

Chapter 4: The European Union Emissions Trading System

Domestic Influences on Climate and Environmental Policy

Individual state preferences for strong or weak environmental regulation, combined with other contextual factors like levels of corruption and energy production, all influence states' capacity and desire to reduce their emissions. Some member states simply have a longer history, and greater degree of institutionalization, of environmental protection than others. For example, many countries established their environmental agency around the same time, in the late 1960s or early 1970s (Jäncke 2002), while others like Portugal, Spain, and Greece all lacked an environmental ministry prior to their entering the EU (Anderson and Liefferink 1997, 5).

Public Opinion on Climate Change in the EU. Relative to public opinion in the United States, Europeans seem to exhibit more overall concern about climate change. According to a 2008 Special Eurobarometer Survey, Europeans on average (about 75 percent) view climate change as a very serious problem. Pew (2008) reports that in the U.S. only 44 percent of Americans felt that climate change was a "very serious problem," as compared to 59 percent in the United Kingdom, which was the lowest percentage of any member state. Member states that had the highest percentage of respondents agree that climate change is a "very serious problem" included Cypress (96 percent), Greece (95 percent), Slovenia (89 percent) and Malta (88 percent). In the EU, those respondents most likely to agree that climate change is a very serious problem are in the 25 to 54 age group, and better educated. The effect of partisanship was relatively small, with differences ranging from 80 percent of individuals on the left, 73 percent in the center and 74 percent on the right.

Ideology. In the United States, liberal Democrats are most likely to be supportive of strong environmental policies and are also more likely to support climate change policy

(Lindamen and Haider-Markel 2002; Konisky, Milyo and Richardson 2008). Republicans are most likely to oppose environmental policy, be unsupportive of climate policy, and less likely to believe in climate change as an anthropogenic phenomenon. Konisky, Milyo and Richardson (2008) find that in the United States, “the strongest predictors of environmental policy preferences are political attributes” and that “Republicans and ideologically conservative individuals, controlling for their trust in government, are substantially less supportive of further government effort to address environmental issues” (1067).

In Europe, Green parties tend to fall on the left end of the political spectrum. ParlGov.org provides Left/Right scores for political parties on a one-to-ten scale. Political parties rated with lower numbers are more liberal and left leaning, while parties rated with higher numbers are more conservative and right leaning. The Green party in Germany, for example, has a Left/Right score of 2.9. Cabinets that are composed of more left-leaning parties should be more likely to be supportive of environmental and climate policies.

Compliance to Past EU Policies. The number of formal actions against a member state in the European Union can act as an indicator of how well a member state has been complying with existing environmental regulations. Camyar (2007) examined the compliance record of the EU member states to various EU policies and suggested that compliance records are directly influenced by the preferences of domestic actors. Camyar also compiled a dataset of all formal infringement actions taken against individual member states across multiple policy areas, including environmental policy.

Energy Policy. Since the use of fossil fuels can directly lead to increased emissions of CO_2, climate and energy policy can be closely related. The particular mix of fuel sources used in a country has direct implications for the total amount of GHGs they produce. It is important to

again note that the EU ETS includes emissions from oil refineries and coal combustion plants. Countries that are intentionally replacing coal or oil with renewable energy sources for domestic electricity generation would also likely be reducing their emissions from oil refineries and coal plants. However, member states that are large producers of oil would be unlikely to face pressure to reduce production even if domestic demand for oil decreases, given the continued growing demand in other regions of the world. Oil companies have resources to protect their interests. They have direct incentives to support policies that protect the oil industry politically, and oppose policies seen to potentially harm it, like efforts to reduce emissions levels. In representative democracies with low levels of corruption, this can occur in the form of lobbying and interest groups. In more corrupt countries, this can take the form of payments to politicians to influence the direction of policy, or payments to regulators to overlook non-compliance. Wilson and Damania (2005) find evidence of this influence in environmental policy, specifically in cases of resource extraction, like forestry. They suggest that "the large rents associated with resource extraction can be used to evade environmental regulations in a number of ways" (516). Specifically, the authors note that the "surpluses can be used to influence policies through the payment of political contributions to policy makers. Alternatively, environmental regulations can be evaded by paying bribes to lower-level bureaucrats who are responsible for administering policies" (516).

Corruption. Levels of political corruption can have an impact on the quality and efficacy of environmental policy (Lopez and Mitra 2000; Fredriksson and Svensson 2003; Barbier et al. 2005; Wilson and Damania 2005; Pellegrini and Gerlagh 2006a; Pellegrini and Gerlagh 2006b; Woods 2008; Fredriksson and Wollscheild 2010). Woods finds that in the context of the United States, those "states with higher levels of political corruption also have significantly weaker

environmental programs," and this effect is strongest in "states with strong organized manufacturing interests" (Woods 2008, 259). In a comparative study of over forty countries, Pellegrini and Gerlagh (2006a) also found a relationship between corruption and environmental policy. They conclude that high levels of corruption are correlated with lower levels of environmental protection and that environmental policies are most stringent when countries are highly democratic and have low levels of political corruption. There is some evidence that the impact of corruption may be lessened or intensified depending on other political factors, including political competition and party discipline. Wilson and Damania (2005) find a linkage between the levels of political competition and environmental policy and suggest that "higher levels of political competition will lead to the adoption of more stringent environmental policy and higher fines for evading their effects" (528). Fredriksson and Wollscheid (2010) find that in countries with low levels of corruption, high levels of party discipline can "be expected to raise the stringency of environmental policies and reduce pollution problems," but that "when the level of corruption is high, party discipline may enable national party officials to reduce the stringency of environmental policy in exchange for favors" (507).

Post-Communism. Pellegrini and Gerlagh (2006b) note that the ten new member states that joined the EU in 2004 generally had lower levels of income, higher levels of corruption and lower environmental standards than the other countries that were already members of the EU. Most of these new member states were post-communist countries where the governments had seen the environment solely as a source of resources for human needs without any intrinsic value (Mazurski 1991). Post-communist countries also generally lagged significantly behind EU standards, both in environmental legislation and institutional capacity to manage the environment (Scrieciu and Stringer 2008). In addition, they tend to exhibit a weak civil society, and therefore

little demand from organized environmental interests to advocate for policy (Howard 2002). There is also some evidence that relative to other EU member states, citizens residing in post-communist countries are less worried generally about environmental issues. Nistor (2010) finds that there continues to be a "dichotomy that citizens of post-communist, now EU member states are still less environmentally concerned compared to the old member states' citizens especially in terms of behavior" (147).

GDP. The relationship between environmental protection and quality and per capita GDP can vary considerably depending on the type of environmental issue. "The statistical result is somewhat paradoxical or ambivalent, because GDP per capita correlates with environmental improvements in some fields, but with deterioration in others" (Jänicke 2002, 11). In regard to the larger picture, wealthier countries that experience high levels of development and a good quality of life may have more resources to commit to environmental protection. Inglehart (1997) argues that only after a country has "Modernized" can it then turn its attention to other, "Postmaterialist" issues like environmental protection. Similarly, Ringquist suggests that when other societal needs are already met, wealthier countries can "both demand and afford stronger environmental measures" (1993b, 107). Natural resource degradation (like deforestation) can impact poorer nations more severely than wealthier ones, as issues related to heavy industrialization can lead to other types of environmental problems. However, patterns are not always clear and can be complicated by numerous economic pressures from within, and external to, national economies. There is potential, that in the case of carbon emissions, wealthier countries may have more capacity to reduce emissions, but also more capacity to produce emissions. Higher levels of income that facilitate higher levels of production and consumption of goods can lead to larger carbon footprints.

Political Parties. Jensen and Spoon (2011) examine the role of political parties in EU member states meeting their Kyoto emissions targets, and find that member states with green parties in government are more likely to meet their targets over time. They also found that countries with more parties giving "higher priority to the environment in their manifestos" were more likely to meet their targets, and that that was especially true when those parties were in a state's governing coalition (110). Tranter and Western (2009) suggest that Green parties facilitate and enhance the spread of postmaterialist values by acting as "socializing agents that influence the formation of value priorities" (150), especially among younger voters. Tranter and Western also argue that "political parties do not simply reflect public opinion; their actions actively shape opinions and behaviors" (149). This argument that the opinions of political elites influence public opinion, particularly when the public is relatively uninformed about a given issue, has been made by other authors including Lupia and McCubbins 1998; Popkin 1991; and Zaller 1992. The opposite argument has also been made; that it is in fact, public opinion influencing the positions parties are taking (Stimpson 1991, Carruba 2001). This argument has been referred to as the "policy mood" approach and suggests that political elites, who desire to be reelected, will shift their position on issues to respond to the policy preferences of their constituents.

Data and Methods

The following analysis utilizes two ordinary least squares (OLS) regression models and two logistic regression models to examine the influences on levels of CO_2 emissions produced by facilities regulated under the EU ETS from 2005-2010. The first two models examine influences on the verified CO_2 emissions produced by member states. The second set of models uses logistic regression to examine influences on member states' capacity to meet their CO_2

emissions targets. In the tables in the results section below, the coefficients and standard errors are reported. Standard error is a measure of how robust, or reliable, the estimates in the model are. The larger the standard error, the less reliable the results are. In OLS regression, the coefficients represent the amount of change in the dependent variable you would see for a one-unit change in the independent variable. In logit analysis, coefficients are a measure of the magnitude of the effect that the given independent variable has on the dependent variable.

Dependent Variables. The dependent variables used in the analyses are Verified Emissions and Targets. Verified Emissions is a measure of the amount of CO_2 emissions produced per capita by all of the facilities within a member state by all facilities regulated under the EU ETS. Targets is a dummy variable indicating if a member state has met their emissions targets for CO_2 reduction or not.

Independent Variables. Measures of corruption, public opinion on climate change, renewable energy production, oil production, green parties in government, cabinet ideology, length of EU membership, green party representation in the European Parliament, past infringement, gross domestic product, and post-communism are all examined.

The variables used in the following analysis were compiled from a variety of sources into an original dataset. Data was gathered primarily by accessing information available online, with the exception of the Infringement variable, which was acquired by emailing Dr. Isa Camyar who created the larger dataset from which it was constructed. Sources include various EU bodies including Eurostat, the Community Independent Transaction Log, and Eurobarometer; one United States governmental agency (the Energy Information Agency); one non-governmental agency (Transparency International); and two other pre-existing datasets (Parlgov.org and

Camyar's (2007) infringement dataset). Table 4.1 includes a description and source of each variable in the dataset.

Table 4.1: European Union Climate Change Policy Dataset, Variables and Sources

Variable Name	Source	Description
Verified Emissions	Community Independent Transaction Log, Eurostat	This variable is a per capita measure of the amount of CO_2 emissions produced within a member state per year at facilities regulated by the European Union Emissions Trading System. Data available at: http://ec.europa.eu/environment/ets/ ; http://epp.eurostat.ec.europa.eu/portal/page/portal/eurostat/home/
Targets	Community Independent Transaction Log, Eurostat	This variable indicates if a member state has met their CO_2 emissions targets for that year. Coded 1 if a member state met their emissions targets producing fewer emissions than allocated. Coded 0 if they exceeded their targets producing more emissions than allocated. Data available at: http://ec.europa.eu/environment/ets/ ; http://epp.eurostat.ec.europa.eu/portal/page/portal/eurostat/home/
Corruption	Transparency International	This variable is the corruption perception index compiled by Transparency International, and is available at: http://cpi.transparency.org
Public Opinion	Euroabarometer	Percentage of respondents who responded "A very serious problem" to the question "how serious a problem do you think global warming / climate change is at the moment?" From Special Eurobarometer 300. Survey details and results available at: http://ec.europa.eu/public_opinion/archives/eb_special_en.ht
Renewable Energy	Energy Information Agency, Eurostat	This is a per capita measure of the total amount of energy produced per country, per year, in billions of kilowatt-hours from renewable energy sources. Data available at: http://www.eia.gov/cfapps/ipdbproject/iedindex3.cfm?tid=6&pid=29&aid=12&cid=r3,&syid=2005&eyid=2009&unit=BKWH ; http://epp.eurostat.ec.europa.eu/portal/page/portal/eurostat/home/

(Table 4.1 cont'd.)

Oil Production	Energy Information Agency, Eurostat	This is a per-capita measure of oil production in thousands of barrels per day, per country, per year. http://www.eia.gov/cfapps/ipdbproject/IEDIndex3.cfm?tid=5&pid=53&aid=1 ; http://epp.eurostat.ec.europa.eu/portal/page/portal/eurostat/home/
Green in Government	Parliament and Government Composition Database, Holger Döring and Philip Manow, University of Bremen	This variable is a measure of whether or not a green party is a member of the cabinet. Data available at: http://parlgov.org
Cabinet Ideology	Parliament and Government Composition Database, Holger Döring and PhilipManow, University of Bremen	This variable is a measure of government ideology, which is calculated by aggregating data on individual party ideology for parties in the cabinet by year. Data available at: http://parlgov.org
Green Party in EP	Parliament and Government Composition Database, Holger Döring and Philip Manow, University of Breman	This variable is a measure of the number of of seats held by green party members of the European Parliament, by country and year.
Length of Membership		This variable indicates how long a state has been a member of the EU in number of years.
Infringement	Dr. Isa Camyar University of Pennsylvania	This variable will provide a measure of member state's record of compliance with past EU environmental directives. Dataset available by contacting Dr. Camyar at icamyar@sas.upenn.edu
Post-Communist		This variable indicates if a country is a former Communist state. Non-communist states are coded 0, post-communist states are coded 1.

Table 4.2 provides descriptive statistics for all variables included in the analyses in this chapter. When applicable, the country where the highest and lowest observations for a given variable occurred is given. The mean and standard deviation for each variable is also included in Table 4.2.

Table 4.2: European Union Climate Change Policy Dataset, Descriptive Statistics

Variable	Mean	High	Low	Standard Deviation
Verified Emissions Per Capita	4.53	11.42 (Estonia 2007)	1.10 (Latvia 2009)	1.99
Emissions Targets	0.70	1	0	0.46
Corruption	6.51	9.6 (Finland 2005, 2006)	3.4 (Poland 2005)	
Public Opinion	76.95	96 (Cyprus 2008*)	59 (United Kingdom 2008*)	8.82
Renewable Energy	1.39	8.98 (Sweden 2005)	0 (Malta 2005-2008)	1.90
Oil Production	0.61	0.07 (Denmark 2005)	0 (Cyprus, Ireland, Latvia, Luxembourg, Malta)	0.01
Green in Government	0.15	1	0	0.35
Cabinet Ideology	5.43	7.64 (Estonia 2010)	2.78 (Hungary 2005)	1.21
Length of Membership	21	53	0	19.24
Green Party in EP	1.36	14 (Germany 2010)	0 (15 Countries)	2.97
GDP	23630.77	87100 (Luxembourg 2007)	4000 (Bulgaria 2007)	15398.3
Post-Communist		1	0	
Infringement	135.52	215 (Italy)	47 (Denmark)	54.60

Hypotheses.

The models below will test the following hypotheses:

Corruption. Previous work suggests that countries with higher levels of political corruption also tend to have poorer environmental records (Pellegrini and Gerlagh 2006a;

Pellegrini and Gerlagh 2006b; Woods 2008). Given this, higher corruption levels may also influence performance of states in reducing their carbon emissions.

H1: As levels of political corruption increase, amounts of verified emissions will increase.

H2: As levels of political corruption increase, member states will be less likely to meet their emissions targets.

Public Opinion. Public opinion may influence political elites, pressuring them to adopt the positions and policies preferred by the individuals responsible for their reelection (Stimson 1991, Carruba 2001).

H3: As public concern towards global warming as a serious issue increases, amounts of verified emissions will decrease.

H4: As public concern towards global warming as a serious issue increases, member states will be more likely to meet their emissions targets.

Renewable Energy and Oil Production. Energy produced from renewable sources can reduce the amount of emissions produced in a country. When renewable energy sources are available and when reliance on renewable energy is encouraged, there is likely to be a reduced reliance on fossil fuels. Countries that have a well-developed renewable energy industry, or are currently investing to develop the production of renewables, also have organized interests that promote and protect the renewable energy industry.

H5: As the amount of energy produced from renewable sources increases, verified emissions will decrease.

H6: As the amount of energy produced from renewable sources increases, member states will be more likely to meet their emissions targets.

The opposite seems to be true in countries that produce significant quantities of oil. These states are less likely to have policies that provide incentives that would promote the use of renewable energy sources instead of oil. Such countries would have organized interests that would oppose policies discouraging the use of fossil fuels with large carbon footprints.

H7: As domestic oil production increases, verified emissions will increase.

H8: As domestic oil production increases, member states will be less likely to meet their emissions targets.

Green Parties. Since green parties are explicitly pro-environmental, one would expect that the better their representation within a country, the more likely a country would be to adhere to EU environmental and climate policy.

H9: If a green party is a member of the government, verified emissions will decrease.

H10: When green parties are members of the government, member states will be more likely to meet their emissions targets.

H11: As the number of a country's seats held by a green party in the European Parliament increases, verified emissions will decrease.

H12: As the number of a country's seats held by a green party in the European Parliament increases, member states are more likely to meet their emissions targets.

Cabinet Ideology. Green parties tend to be rated as left on the political spectrum, and environmental protection is often associated with liberalism (Lindamen and Haider-Markel 2002; Konisky, Milyo and Richardson 2008).

H13: As government ideology becomes more left-leaning, verified emissions will decrease.

H14: As government ideology becomes more left-leaning, countries will be more likely to meet their emissions targets.

Past Infringement. A member state's past record of compliance to EU environmental regulations is likely a reflection of their overall commitment to adhering to EU environmental standards.

H15: Countries with higher incidence rates of past infringement to environmental policy will have higher levels of verified emissions.

H16: Countries with higher incidence rates of past infringement to environmental policy will be less likely to meet their emissions targets.

Results

In the first OLS regression model examining verified CO_2 emissions per capita (see Table 4.3) Corruption, Renewable Energy, Cabinet Ideology, Length of Membership, GDP, Post-Communist, and the interaction term, Length*Corruption, all have statistically significant effects.

Table 4.3: Influences on Verified Greenhouse Gas Emissions Per Capita

	Coefficient	**SE**
Corruption [-]	1.463492***	0.2378705
Public Opinion [-]	-0.0163761	0.021989
Renewable Energy [-]	-0.9225683***	0.0939313
Oil Production [+]	-13.97289	9.532281
Green in Government [-]	-0.1629097	0.4716856
Cabinet Ideology [+]	0.2574416*	0.1391064
Length of Membership	0.1534532 ***	0.0404476
Green Party in EP [-]	0.1092365	0.0685415
GDP	0.0000473**	0.0000149
Post-Communist	1.205369**	0.5369823
Length*Corruption	-0.0337108***	0.0064821
Constant	-3.477226	2.440735

N = 154
Prob > F = 0.0000
R-squared = 0.3741
*p>.10, **p>.05, ***p>.001 (two-tailed tests)

Corruption is statistically significant, but in the opposite direction as predicted in H1 (see Figure 4.1). A decrease in corruption is associated with an increase in emissions (higher scores indicating lower levels of corruption). The predicted values suggest that, holding all other variablesat their means, countries with the lowest corruption (near a CPI score of 9) have per capita emissions near seven tonnes of CO_2, while those that are the most corrupt (with scores near 4) would have emissions levels about half of that amount. Most of the countries in the EU with higher levels of corruption are post-communist, and even when this and GDP are taken into account, as countries become more corrupt, verified emissions decrease[15].

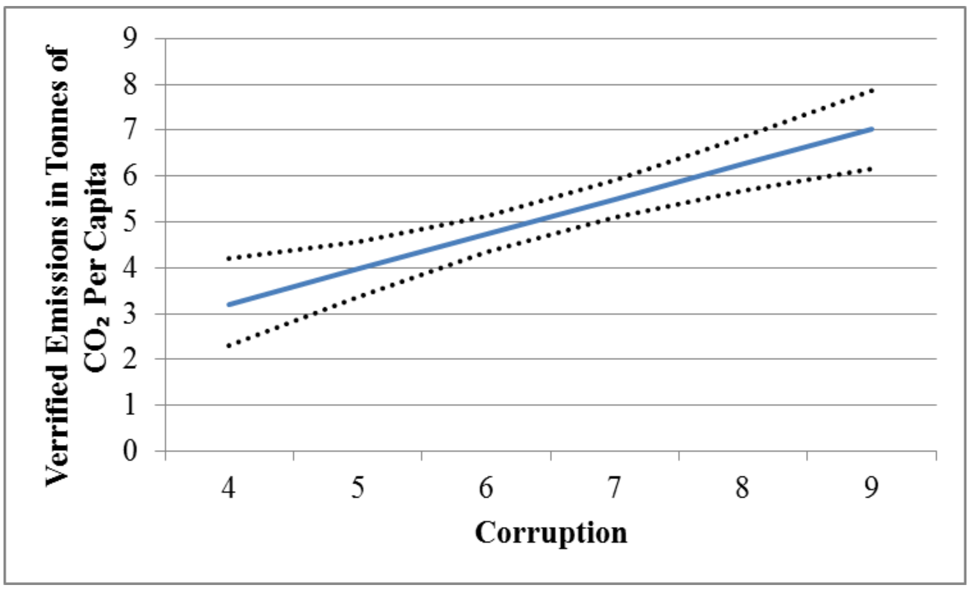

Figure 4.1: Predicted Values of Verified Emissions Per Capita for Corruption

Renewable energy is significant in the direction predicted supporting H5; as the amount of energy produced from renewable sources increases, verified emissions will decrease (see

[1515] When the model includes only post-communist countries, dropping all other EU member states corruption is no longer significant. The interaction term, length*corruption also loses statistical significance. However, in that model public opinion, oil production, green in government all have significant effects.

Figure 4.2). Though it is not possible for CO_2 emissions to be negative, the overall trend indicated by the predicted values shows a strong pattern of significant reduction in emissions per person as renewable energy production increases.

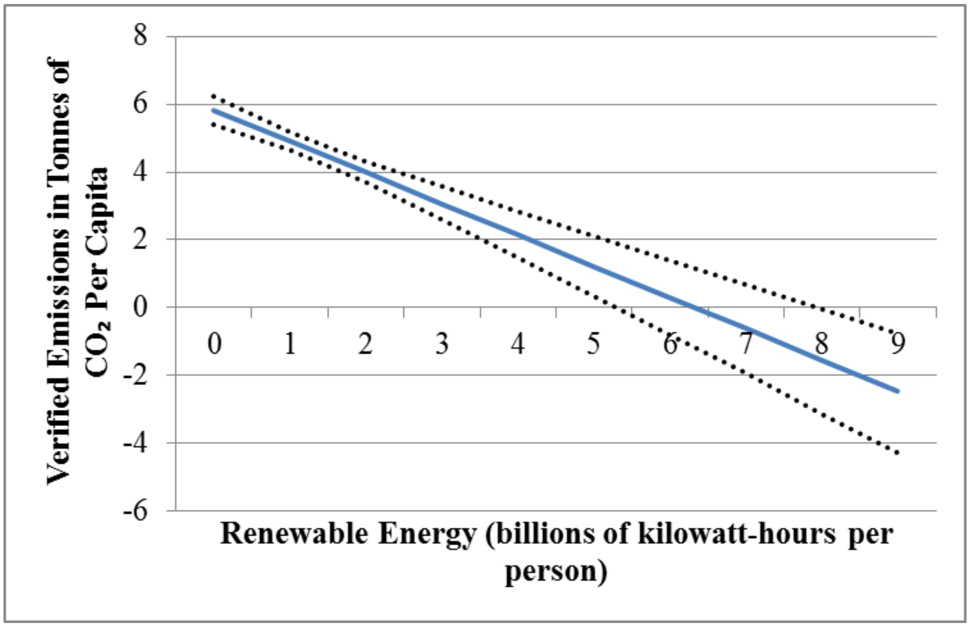

Figure 4.2: Predicted Values of Verified Emissions Per Capita for Renewable Energy

Cabinet ideology reaches statistical significance, and as suggested by H13, as the average liberalism of a cabinet increases, their verified emissions levels decrease. Length of membership is also significant. The longer a country has been in the EU, the higher their emissions are per-capita.

The independent effect of length of membership on verified emissions is positive and statistically significant, indicating that the longer a country has been an EU member, the higher their emissions. However, the effect of length of membership is also dependent upon corruption. Figure 4.3 illustrates predicted values of verified emissions per capita for a range of values of length of membership controlling for other factors.

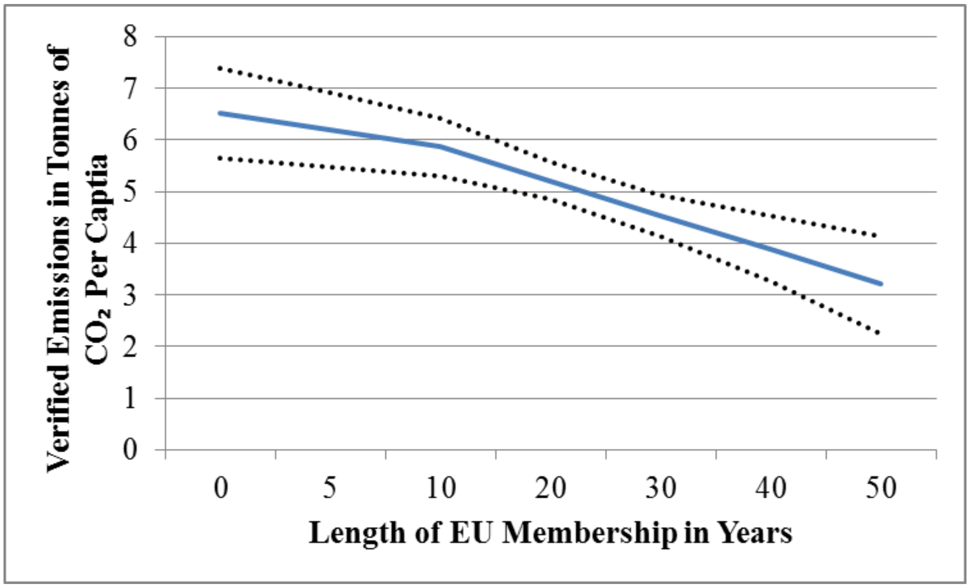

Figure 4.3: Predicted Values of Verified Emissions Per Capita for Length of Membership

GDP also has a statistically significant effect. As GDP increases, so do emissions levels. The interaction term, Length*Corruption, is also statistically significant. Post-communism has a surprising significant effect. Post-communist states are more likely to reduce emissions than states that never experienced communism. Public Opinion and Green in Government had effects in the predicted direction, but did not reach statistical significance. Green Party representation in the European Parliament and domestic oil production levels also lacked significance in this model.

Model 2 is also an OLS regression model examining verified emissions per capita, but controls for a member state's previous record of complying with other EU environmental policies (see Table 4.4). It is important to note that this model includes only the EU 15. Past infringement, Corruption, Renewable Energy, Oil Production, Length of Membership, and Length*Corruption all have statistically significant effects. Public Opinion, Green in Government, Cabinet Ideology, Green in EP, and GDP all fail to reach levels of statistical significance. The results indicate that higher numbers of past infringement actions are associated

with lower levels of emissions. This effect is statistically significant, but in the opposite direction than that predicted by H15.

Table 4.4: Past Infringement and Verified Greenhouse Gas Emissions Per Capita

	Coefficient	SE
Infringement [+]	-0.0285063***	0.0053388
Corruption [-]	1.062388 **	0.3804962
Public Opinion [-]	0.0163711	0.0255494
Renewable Energy [-]	-1.02941***	0.1193653
Oil Production [+]	-17.43542**	6.183592
Green in Government [-]	0.3257044	0.3144183
Cabinet Ideology [+]	-0.1680222	0.1075313
Length of Membership	0.1896337**	0.0598402
Green Party in EP [-]	0.1005218	0.0684848
GDP	0.0000109	0.0000129
Length*Corruption	-0.0340727***	0.0083003
Constant	3.608948	4.611552

N = 90
Prob > F = 0.0000
R-squared = 0.5556
*p>.10, **p>.05, ***p>.001 (two-tailed tests)

In this model, Corruption has a significant, positive effect. Countries that are more corrupt are associated with lower levels of carbon emissions. This is opposite of the effect predicted by H1. Figure 4.4 illustrates the predicted values for corruption at different levels of emissions per capita, holding all other variables at their mean. As countries become less corrupt, verified emissions per capita increase. This effect is the same as in Model 1, but the magnitude of the effect is smaller. Countries that are the most corrupt, with a Corruption Perception Index of 4, are predicted to produce two tonnes of CO_2 per person, while the least corrupt countries (with corruption scores of nine) have CO_2 emissions of about 3 tonnes per person. Renewable energy use also has the same effect as in Model 1, providing additional evidence that as renewable energy use increases, verified emissions decrease, supporting H5 (see Figure 4.5).

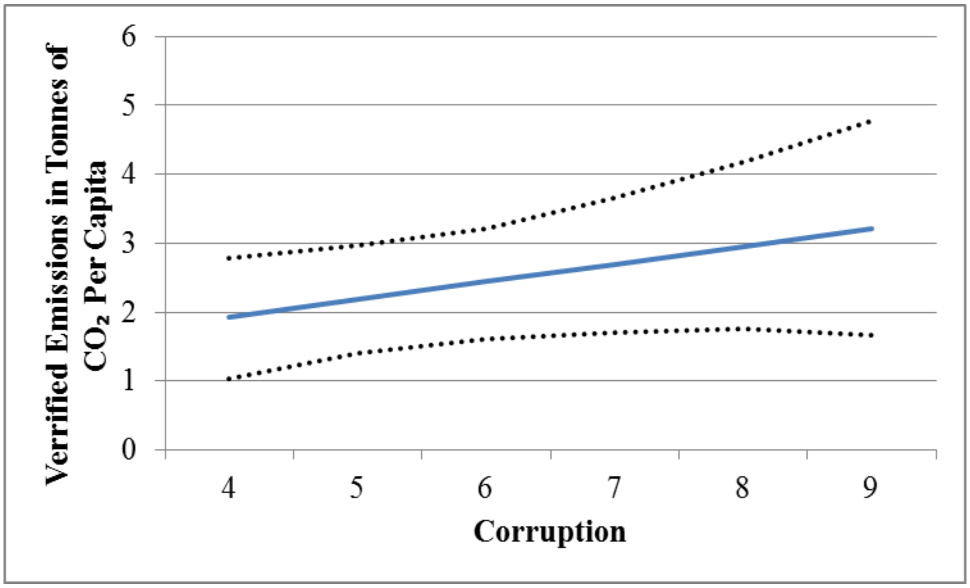

Figure 4.4: Model 2 Predicted Values of Verified Emissions Per Capita for Corruption

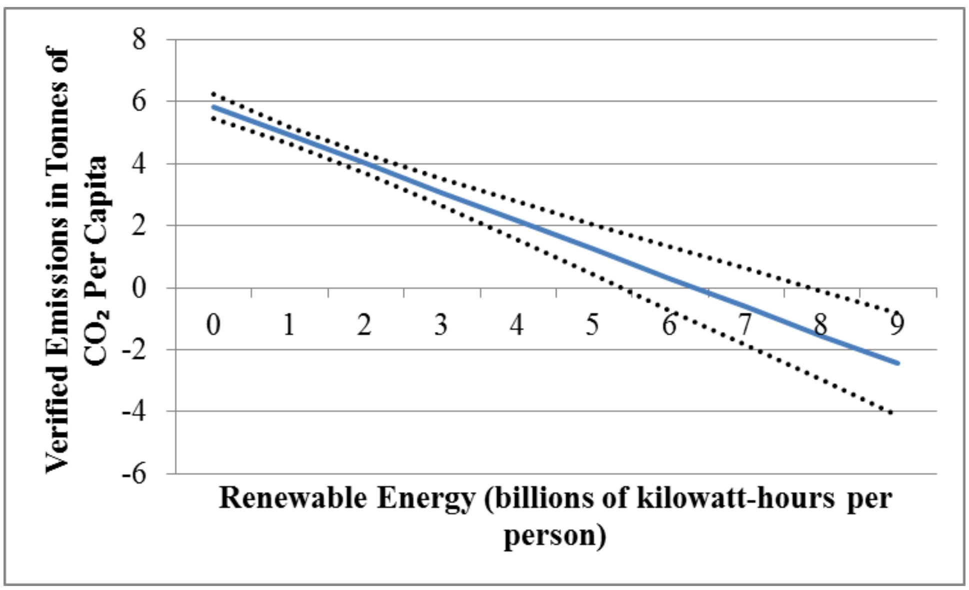

Figure 4.5: Model 2 Predicted Values of Verified Emissions Per Capita for Renewable Energy

Surprisingly, in Model 2, increasing domestic oil production is associated with decreasing emissions. This effect is opposite of that predicted by H7. This seems counterintuitive given that oil production and use is an obvious source of CO_2 emissions, and countries that are large oil producers should face political pressure and economic incentives to maintain high levels

of production. Length of membership in the EU also has statistically significant, positive effect, providing evidence that countries that have been in the EU longer have higher per-capita rates of verified emissions than newer member states. However, the effect of length of membership is also contingent upon the effects of corruption. In this model the interaction term, Length*Corruption, is also significant. Figure 4.6 illustrates predicted values of verified emissions per capita for a range of values of length of membership controlling for other factors. Public Opinion, Green in Government, Cabinet Ideology, Green in EP, and GDP all fail to achieve significance in Model 2.

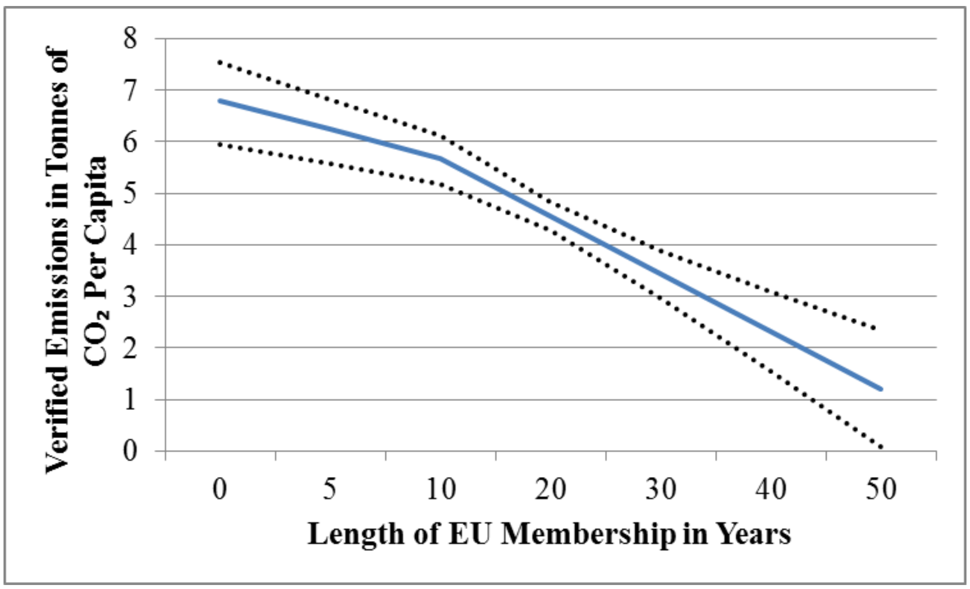

Figure 4.6: Model 2 Predicted Values of Verified Emissions Per Capita for Length of Membership

Model 3 examines influences on member states meeting their emissions reductions targets established in annual National Allocation Plans (see Table 4.5) using logit analysis. Corruption, Renewable Energy, Oil Production, Length of Membership, and Length*Corruption all have statistically significant effects on states meeting their targets.

Table 4.5: Meeting EU ETS Targets

	Odds Ratio		SE
Corruption [-]	0.3624515**	[-]	0.1507959
Public Opinion[-]	0.99929	[-]	0.0318465
Renewable Energy[-]	1.650707**	[+]	0.3029717
Oil Production [+]	8.33 e-30*	[-]	2.88 e-28
Green in Government [-]	0.8845859	[-]	0.4690984
Cabinet Ideology [+]	1.156223	[+]	0.1962571
Length of Membership	0.8014083**	[-]	0.0602298
Green Party in EP [-]	0.9288379	[-]	0.091076
GDP	0.9999861	[-]	0.0000225
Post-Communist	0.8085632	[-]	0.5029175
Length*Corruption	1.035075**	[+]	0.0120144

N = 154
Prob Chi2= 0.0246
Pseudo R^2 = 0.1791
*p>.10, **p>.05, ***p>.001 (two-tailed test)
Bracketed positive and negative signs after the odds ratio indicate the direction of the effect from the z score.

In this model, corruption has statistically significant negative effects, consistent direction predicted by H2. States that are more corrupt are less likely to meet their emissions targets, while countries that are least corrupt are more likely to meet them. Figure 4.7 illustrates the predicted probability of meeting emissions reductions targets at various levels of corruption. Countries that are the most corrupt with corruption scores of three have a 28% chance of meeting their targets, while least corrupt countries with scores of nine have a 57% chance of meeting their targets. The amount of energy produced from renewable energy has a significant effect, but one that is opposite of the prediction of H6. In this model, countries producing more renewable energy are less likely to meet their EU emissions targets. It is interesting to note that renewable energy production had an opposite effect on the reduction of verified emissions in models 1 and 2. Figure 4.8 illustrates the predicted probability of a state meeting their emissions targets at various levels of renewable energy production, holding all other variables at their means. Countries producing no electricity from renewable sources are predicted to have a 42.7% chance

of meeting their targets while countries producing 9 billion kilowatt hours per capita of electricity from renewable sources had only a 2.4% chance of meeting targets.

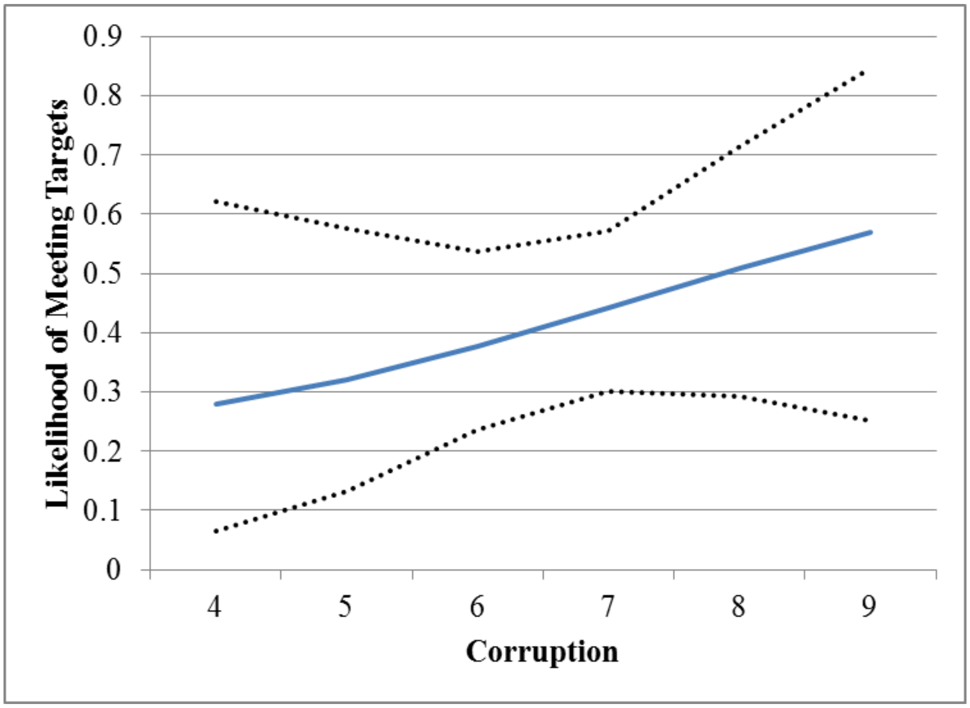

Figure 4.7: Predicted Probabilities of Meeting Targets for Corruption

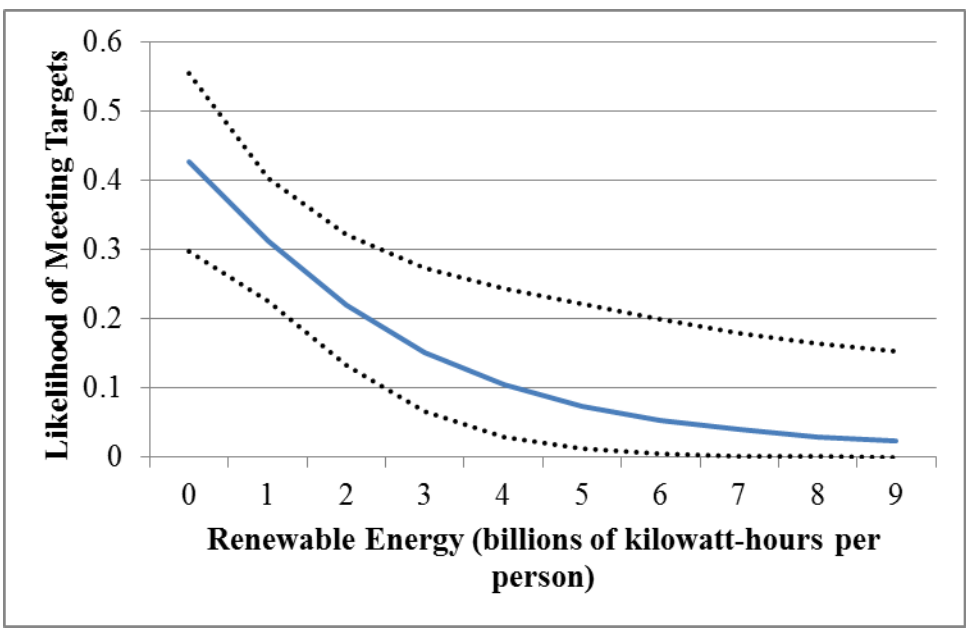

Figure 4.8: Predicted Probabilities of Meeting Targets for Renewable Energy

Higher levels of oil production are surprisingly statistically significantly related to meeting targets. Length of membership in the EU, as well as the interaction term, Length*Corruption, also reach statistical significance. However, the substantive effect of length of membership on the likelihood of meeting emissions targets is small (see Figure 4.9). Public Opinion, Green in Government, Cabinet Ideology, and Green in EP all have effects in their respective predicted directions, but do not reach statistical significance. Post-Communist and GDP also fail to reach significance.

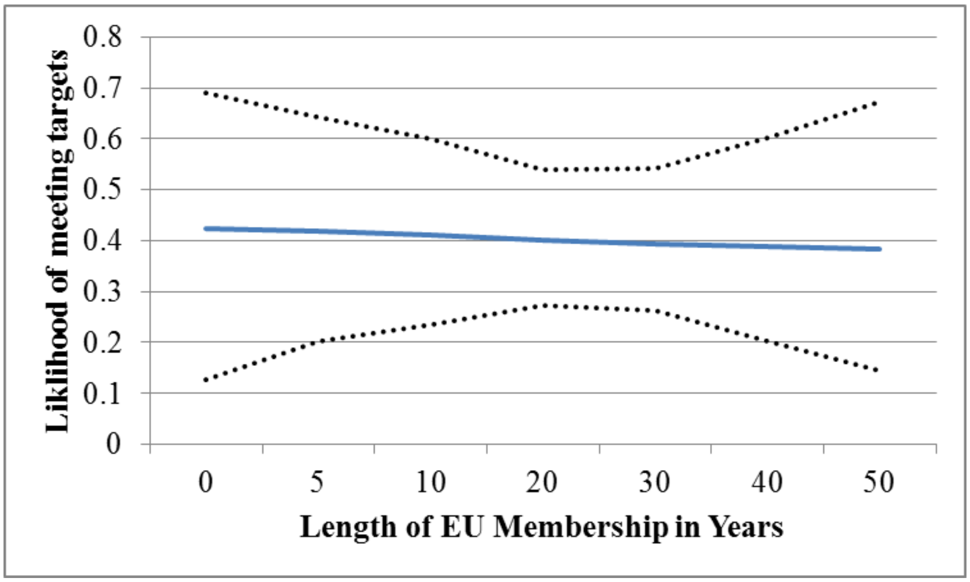

Figure 4.9: Predicted Probabilities of Meeting Targets for Length of Membership

Model 4 is a logit analysis examining member states meeting emissions targets when controlling for past compliance to other EU environmental directives (see Table 4.6). Note that this Model, like Model 2, also only includes the EU 15. In this model, only Renewable Energy and Green Party in EP have statistically significant effects. Increasing renewable energy production is negatively associated with meeting EU emissions targets, similar to the effects seen in Model 3. This is inconsistent with the hypothesized effects of this variable and therefore does not provide any evidence for H6.

Table 4.6: Past Infringement and Meeting EU ETS Targets

	Odds Ratio		SE
Infringement [+]	1.004304	[+]	0.0133397
Corruption [-]	0.6226579	[-]	0.5034612
Public Opinion[-]	1.076834	[+]	0.0558089
Renewable Energy[-]	3.437218**	[+]	1.683057
Oil Production [+]	1.63 e-28	[-]	6.59 e-27
Green in Government[-]	0.50789	[-]	0.3648773
Cabinet Ideology [+]	0.838841	[-]	0.2406372
Length of Membership	0.9355654	[-]	0.1338705
Green Party in EP [-]	0.7807188**	[-]	0.976584
GDP	0.9999617	[-]	0.0000283
Length*Membership	1.030415	[+]	0.0211617

N = 90
Prob Chi2= 0.0425
Pseudo R^2 = 0.2764
*p>.10, **p>.05, ***p>.001 (two-tailed test)
Bracketed positive and negative signs after the odds ratio indicate the direction of the effect from the z score.

Past Infringement, Corruption, and Green in Government all had effects in the predicted direction, but failed to reach levels of statistical significance. Public Opinion, Oil Production, Cabinet Ideology, Length of Membership, GDP, and Length*Corruption all failed to have statistically significant effects in Model 4. Figure 4.10 illustrates the predicted probabilities of meeting targets at various levels of per-capita renewable energy production. Green party representation in the European Parliament is associated with meeting targets, providing evidence for H12 (see Figure 4.11). Countries with no green party representation in the EP have a 22% chance of meeting targets while countries with 14 green party members in the EP are predicted to have an 84% chance of meeting targets.

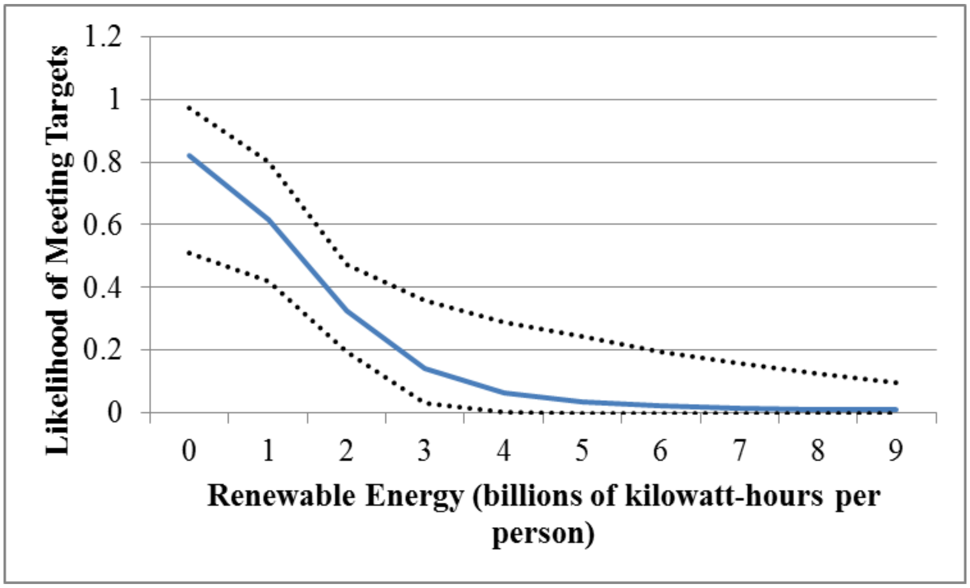

Figure 4.10: Predicted Probabilities of Meeting Targets for Renewable Energy

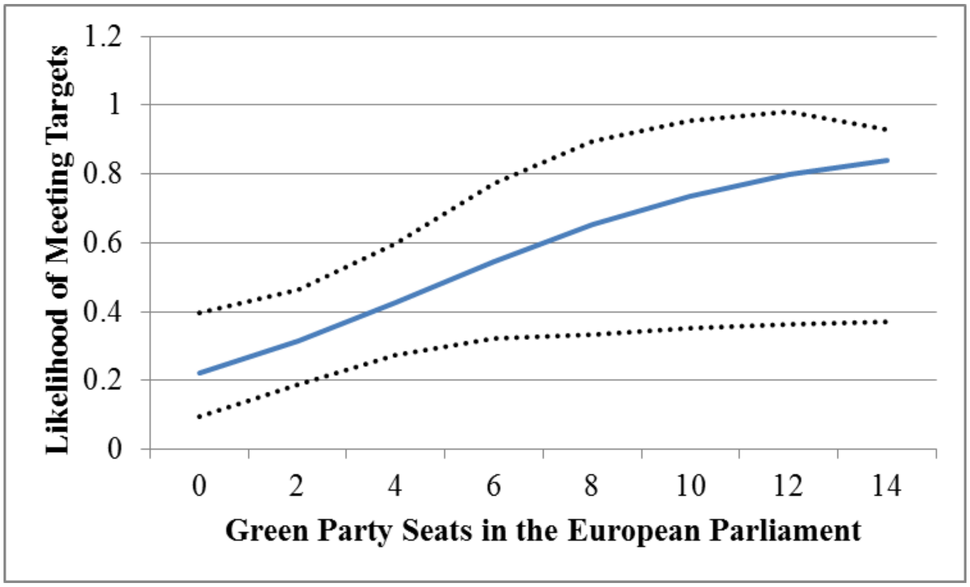

Figure 4.11: Predicted Probabilities of Meeting Targets for Green Party Seats

Discussion

Since the EU ETS has been relatively recently created and given that a portion of the time period examined includes the trial phase, it will be important to continue to evaluate this program to see if the patterns discovered in this analysis continue into the future, or if they change once it

becomes better established. The factors influencing the reduction of emissions per-capita and those influencing meeting EU targets seem to be somewhat unexpectedly different (see Table 4.7).

Table 4.7: Comparative Model Results: Directional Effects and Significance Levels

Variables and Predicted Directions	Model 1: Verified Emissions	Model 2: Past Infringement and Verified Emissions	Model 3: Meeting Emissions Targets	Model 4: Past Infringement and Meeting Targets
Past Infringement [+]		-***		+
Corruption [-]	+***	+**	-**	-
Public Opinion [-]	-	+	-	+
Renewable Energy [-]	-***	-***	+**	+**
Oil Production [+]	-	-**	-*	-
Green in Gov [-]	-	+	-	-
Cabinet Ideology [+]	+*	-	+	-
Length of Membership	+***	+**	-**	-
Green in EP [-]	+	+	-	-**
GDP	+**	+	-	-
Post-Communist	+**		-	
Length*Corruption	-***	-***	+**	+

A change in verified emissions over time indicates the actual results of efforts to reduce the total levels of emissions across all EU ETS facilities in a country. This number in some ways is a more direct measure of success than simply meeting emissions targets. Targets are proposed by countries in their National Allocation Plans, then approved or disapproved by the Commission. This allows for political influence in the process of setting the targets themselves. Countries with fewer resources, poorer institutional capacity, or those that are just poorer, can be given more leeway than richer states with highly developed environmental institutions; especially since the burden of meeting Kyoto standards is spread across the entire EU, rather than expecting each country to individually reduce emissions to a specific level.

Hypotheses

Corruption. Two hypotheses relating to corruption were proposed. H1 states that as political corruption increases, verified emissions will increase. Models 1 and 2 offer no evidence that this is the case, but instead the effect of corruption was statistically significant in the opposite direction. In both models, the independent effect of corruption on verified emissions is negative and statistically significant, indicating that as levels of corruption increase, verified emissions decrease. However, the effect of corruption is also dependent upon length of membership. In both models, Length of Membership and the interaction term, Length*Corruption, also had statistically significant effects. H2 relates to Model 3 and Model 4 and states that as levels of political corruption increase, member states will be less likely to meet their emissions targets. The results of Model 3 provide evidence in favor of this hypothesis. In Model 3, as corruption levels increase, likelihood of meeting emissions targets decrease. This model includes all 27 member states, while Model 4 includes only the EU 15; therefore, it is interesting to note that this effect occurs when examining the EU as a whole, but disappears when only examining the EU 15 and controlling for past environmental infringement actions. However, the effect of corruption is again related to Length of Membership in this model. Additional research may better disentangle the significant relationship between these two variables, especially given that it is not driven by the effects of post-communism which is accounted for in Model 1 and Model 3 and irrelevant in Model 2 and Model 4.

Public Opinion. Public opinion did not have a statistically significant effect in any of the models; therefore, H3 and H4 are not confirmed.

Renewable Energy and Oil Production. Hypothesis H5 indicates the anticipated effect of renewable energy production on verified emissions, stating that as the amount of energy

produced from renewable sources increase, verified emissions will decrease. Renewable Energy is statistically significant in both Model 1 and Model 2, providing strong evidence that as renewable energy production goes up, emissions levels will go down. This seems intuitive, given that the amount of energy produced by renewables would generate fewer carbon emissions than had the same amount of electricity been generated using another fuel source like coal. Renewable Energy also had a statistically significant effect in Models 3 and 4, but in the opposite direction as predicted in H6. These models found that as renewable energy production increases, member states are *less* likely to meet their emissions targets.

High levels of oil production were hypothesized to have negative impacts on the reduction of verified emissions, as well as the meeting of targets (H7 and H8). However, the results of the models do not provide evidence of this. Oil production did have statistically significant effects in Model 2 and Model 3, but opposite of the direction predicted. In Model 2, including the EU 15, increasing oil production was associated with decreasing verified emissions. In Model 3, including all 27 member states, increasing oil production was associated with an increased likelihood of meeting emissions targets. This is a surprising finding, however, given that the countries producing the largest amounts of oil, Denmark, the United Kingdom, produce drastically more than other EU countries. In future research, it would be interesting and helpful to sort out patterns for the largest oil producers - Denmark and the UK - from countries producing oil but in smaller amounts, and those countries that produce no oil domestically. In addition, countries like the UK and Denmark are very unlikely to stop, or even reduce, oil production as they move toward other fuel sources for domestic electricity generation. The emissions generated by the use of the oil produced will simply shift to the countries with higher demand for oil willing to purchase it.

Green Parties. Hypotheses H9 and H10 suggest that if a green party is a member of the government, verified emissions will decrease and the likelihood of meeting targets will increase. No evidence was found across any of the models supporting either of these hypotheses. The variable Green in Government did not reach statistical significance in any of the models. H11 states that as the number of a country's seats held by a green party in the European Parliament increases, verified emissions will decrease. No evidence to support this hypothesis was found in Model 1 or Model 2. H12 states that as the number of a country's seats held by a green party in the European Parliament increases, member states are more likely to meet their emissions targets. Model 3 does not provide evidence supporting this, but in Model 4 as green party representation in the EP increased, the likelihood of meeting targets also increased. Therefore, there is support for H12, but only for the EU 15.

Cabinet Ideology. Hypothesis H13 stated that as government ideology becomes more left-leaning, verified emissions will decrease. In Model 1, left-leaning governments were associated with reduction of verified emissions indicating that, for the EU 27, this is the case. However, in Model 2, which only includes the EU 15 and accounts for past infringement, the effect of cabinet ideology was not significant. The variable, Cabinet Ideology, did not have statistically significant effects in Model 3 or in Model 4, therefore H14 is not supported, and does not seem to influence likelihood of meeting emissions targets.

Past Infringement. The variable Past Infringement was only included in Model 2 and Model 4 and was only available for the EU 15. Past Infringement was statistically significant in Model 2, but in the opposite direction predicted by H15. Past Infringement was not significant in Model 4; therefore H16, countries with higher past infringement will be less likely to meet targets, is not supported.

Conclusions

Renewable energy production was the only variable with statistically significant effects in all four models. Not surprisingly, countries producing more renewable energy per person were also likely to have lower levels of verified carbon emissions. This is likely due to the direct reduction in carbon emissions due to a replacement of fossil fuels by renewable energy sources. This finding could also indicate that a country was committing to reducing their national GHG emissions through changes in energy policy as well as through the ETS. The effects found for Renewable Energy on the likelihood of meeting targets are surprising. Opposite effects are observed when considering countries' abilities to meet emissions targets. Countries producing less electricity from renewable sources are more likely to meet targets.

The relationship between Length of Membership and Corruption is significant, but why is still unclear. The length of time a state had been a member of the European Union had a significant, positive effect in Models 1 and 2 (see Tables 4.3 and 4.4). The longer countries were members of the EU, the better they were at reducing their per-capita emissions levels. Length of membership had the opposite effect on meeting emissions reduction targets, potentially indicating that targets for older members may have been more stringent and difficult to meet than those for newer member states. In addition, countries that have more recently joined the EU had an incentive prior to joining the EU to demonstrate the willingness and capability to move toward compliance; new member states may therefore be relatively likely to be in compliance. Corruption also had a significant positive effect in Model 1 and Model 2, but an effect in the opposite direction for meeting targets. The interaction term, Length*Membership, is also significant across Models 1, 2, and 3. These effects are not driven my any factors related to post communism or GDP, since they are accounted for in the model.

Chapter 5: Case Selection and Methods

Methods

In order to further examine the influences on member states ability to reduce their carbon emissions under the EU ETS four qualitative case studies of individual member states are examined in the following chapters. The cases will allow additional examination of the variables included in the statistical analysis, but within the context of other factors specific to each individual country included. This chapter describes the methods that will used to conduct the case studies as well as the reasoning for selecting the cases examined in the following chapters.

Structured Focused Comparison. The cases examined in this study employ the logic of structured, focused comparison. "Structured, focused comparison is a simple method of approaching case studies. It is an approach that "is "structured" in that the researcher writes general questions that reflect the research objective and that these questions are asked of each case under study to guide and standardize data collection, thereby making systematic comparison and cumulation of the findings of the cases possible." (George and Bennett 2005, 67)

The selected cases will include examination of the same variables from the statistical analysis found in chapter 4; corruption, public opinion on climate change, renewable energy production, oil production, green party representation in government, cabinet ideology, length of European Union membership, green party representation in the European Parliament, GDP, and past infringement actions taken against the state. Comparison of the cases across several other areas is also conducted to further examine other potential influences on state's abilities to reduce their carbon emissions that would have been difficult to include in the statistical models in the form of questions that will form the basis of my structured focused comparison.

The questions examined will help to provide additional information not captured by the operationalization of the variables included in the statistical analysis, or left out of the analysis due to difficulty of operationalization or data availability. The questions cover information about the structure of government, energy politics and policy, vulnerability to climate change and any additional policies in place at national level to combat climate change.

The questions I will examine for each case include:

1) What is quality of life like in the country?
2) How corrupt is the government?
3) How long has the country been a member of the EU and is it a member of the Eurozone?
4) What party or parties control government and what are their ideological positions?
5) Is there green party representation in the government or legislature?
6) Is there green party representation in the European Parliament?
7) Has the country traditionally been a leader or laggard in environmental policy?
8) When was the country's first environmental ministry or institution established?
9) What is the country's record of compliance with existing EU environmental policy?
10) What sources of energy does the country currently rely on for its total generation of electricity?
11) Is the country a major producer of oil or renewable energy?
12) What is the potential for additional use of solar or wind energy in the country?
13) Is the member state vulnerable to the projected effects of climate change in the form of temperature changes, flooding, drought, or other changes?
14) What measures or policies does the member state have in place to adapt to potential effects of climate change?

15) What are overall levels of GHG production like in the country?

Case Selection

Prior to selecting which member states to examine in greater detail though case study analysis, a comparison was made of all potential cases, the 27 member states of the European Union, across the data used in the statistical analysis.

Leaders and Laggards. The dependent variables in my statistical models, verified emissions and meeting emissions targets, are both measures indicating a member state's overall progress towards reducing emissions regulated under the Emissions Trading System but provide slightly different information; because of this, it seems especially relevant to compare the performance of all member states across these measures. Figure 5.1 shows the ranking of all member states from best to worst in their average emissions reductions. The first column ranks member states based on their total verified emissions per capita from ETS regulated facilities from 2005-2010. The second column ranks member states based on the difference between their allocated and verified emissions from ETS facilities. Slovenia, Ireland, Greece, Denmark, Spain, Italy, Germany and the United Kingdom were the only member states who did not meet their emissions reduction goals, while all other member states were able to exceed their targets, reducing their emissions even further than the goals established in their respective national allocation plans.

In the literature on comparative environmental policy in Europe some countries have been considered policy "leaders" and some have been considered policy "laggards." Denmark, Germany, Austria, Sweden, Finland and the Netherlands all have records as leaders in environmental policy while Portugal, Greece, Italy, Spain, Ireland, and Belgium all have

reputations as environmental laggards (Anderson and Liefferink, 1998, Barnes and Barnes, 1999).

Verified Emissions

1. Latvia
2. Lithuania
3. France
4. Sweden
5. Hungary
6. Romania
7. Portugal
8. Italy
9. Spain
10. Austria
11. United Kingdom
12. Slovenia
13. Slovakia
14. Ireland
15. Bulgaria
16. Malta
17. Netherlands
18. Belgium
19. Luxembourg
20. Denmark
21. Poland
22. Germany
23. Greece
24. Cyprus
25. Finland
26. Czech Republic
27. Estonia

Emissions Targets

1. France
2. Poland
3. Romania
4. Czech Republic
5. Slovakia
6. Belgium
7. Portugal
8. Lithuania
9. Netherlands
10. Sweden
11. Hungary
12. Finland
13. Estonia
14. Bulgaria
15. Latvia
16. Austria
17. Luxembourg
18. Malta
19. Cyprus
20. Slovenia
21. Ireland
22. Greece
23. Denmark
24. Spain
25. Italy
26. Germany
27. United Kingdom

Figure 5.1: Emissions Reductions in the European Union: Climate Leaders and Laggards

The four final cases selected for analysis include two traditional “leader” states, Sweden and Denmark, and two traditional “laggard” states, Portugal and Greece. Based on their previous reputations, one might assume that Sweden and Denmark would be more effective at reducing their emissions than Portugal and Greece. However, the performance of these countries in regard to emissions reduction is not so simple. Sweden is doing well in reducing its overall emissions

from EU ETS facilities, ranking third out of all EU member states and meeting its targets, while Denmark has been struggling to reduce its CO_2 emissions. An examination of the emissions reduction performance of the traditional laggards reveals that, Portugal has been successful in reducing their overall verified emissions from EU ETS facilities, while Greece has had little success, frequently missing its targets and having the 23rd worst record in overall verified emissions rates. The following chapters examine the factors influencing the differences in emissions reduction in these states.

The cases are also divided geographically: two northern cases and two southern cases. This will account for potential differences in political culture as well as structural differences in energy needs and consumption (heating and cooling costs, more or less potential solar energy dependent on latitude). The cases also may provide insight into the role that corruption levels play since that was a poorly explained effect in the statistical model. Sweden and Portugal are preforming well, but vary on levels of corruption – Sweden with very low levels and Portugal with somewhat high; and Denmark and Greece who are both doing poorly in reducing emissions but also represent one country with very low levels of corruption and the other with high levels.

The following chapters will answer the above questions for each case; Sweden, Denmark, Portugal, and Greece, and Chapter Ten concludes by comparing all four cases against each other and against the results of the statistical analysis.

Chapter 6: Sweden

Introduction

Sweden is a constitutional monarchy located in northern Europe. The monarch is the ceremonial head of state and the prime minister is the head of government. The parliament is unicameral and elected using proportional representation. The country is a unitary consensus democracy characterized by coalition governments, an executive-legislative balance of power, and a multiparty system electing its representatives using proportional representation (Lijphart 1999). Lijphart also famously argued that consensus style democracies are “kinder, gentler” and “have a better record with regard to protection of the environment” (275) This seems to be the case in Sweden, which is considered to have a pattern of consensus democracy similar to the other Nordic countries that is marked by a “distinctly Scandinavian culture of consensus” and has institutions that enhance “conciliation and arbitration” (Elder, Thomas, and Arter 1988, 221). In Swedish policy making in particular, “there is a long tradition of seeking consensus between opposing groups and interests through negotiations. In this process mutual trust is built” (Kronsel in Anderson and Liefferink 1997, 57). Ostrom (1990) suggested that building trust through repeated interactions of stakeholders is key to managing common pool resources, particularly environmental resources.

Overall, quality of life is considered very high because of relatively high per capita GDP, long life expectancy, good access to education and health care,[16] and very low levels of corruption. GDP per capita in 2010 was €37,000[17] and average life expectancy at birth was 80 for men and 84 for women. Sweden provides various and extensive social welfare programs to its citizens including universal health care (Wright 2004). Adult prevalence of HIV/AIDS is low,

[16] Health and education statistics from CIA World Factbook, available at: https://www.cia.gov/library/publications/the-world-factbook/geos/sw.html
[17] Source: Eurostat available at: http://epp.eurostat.ec.europa.eu/portal/page/portal/statistics/themes

comprising 0.1 percent of the population, and adult obesity rates are also relatively low at 12 percent of the population. Free public day care for children aged one through six is available and 90 percent of students go on to attend upper secondary school after completing their compulsory education. Sweden's adult literacy rate is 99 percent.[18] Sweden also ranks highly on the United Nation's Human Development Index, ranking 10th in 2011 and falling under the category of 'very high' human development.[19] All of these factors combined would suggest Sweden is a "Postmaterialist" country.

After elections held in September of 2010, the cabinet was composed of four parties: the Moderate Coalition Party (107 seats out of a total 349 in the Riksdag, left/right score of 7.8, leaning right), the Liberal People's Party (24 seats, left/right score 6.2), the Centre Party (23 seats, left/right score 5.8), and the Christian Democrats (19 seats, left/right score 7.0) leading to an overall right leaning cabinet (ParlGov.org). Sweden ranks fourth in the world on the Corruption Perceptions Index,[20] being one of the least corrupt countries in the world, scoring a 9.3 in 2011 on a zero to ten score of corruption. Sweden joined the European Union in 1995, the same year as Austria and Finland, and in 2003 rejected adopting the Euro in a national referendum.

Environmental Institutions and Past Environmental Record

Sweden has been a leader in establishing environmental policies and institutions, views itself as a proactive role model for other countries, and has tried to influence and improve overall levels of environmental protection at the level of the European Union. Sweden was a "pioneer" in regard to establishing its own domestic environmental policy. "Modern environmental policy

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[18] See State Department Background Note: Sweden for more information. Available at: http://www.state.gov/r/pa/ei/bgn/2880.htm
[19] See http://hdr.undp.org/en/statistics/ for more information.
[20] See http://cpi.transparency.org/cpi2011/

in Sweden dated back to the 1964 Nature Conservation Act and the 1969 Environment Protection Act. Although these two pieces of legislation are still relevant today, the scope and direction of environmental policy have undergone some major changes since those early years" (Molin 1999, 244). Like early environmental policy in the United States, Swedish policy in the 1960s and 1970s was "rather typical of the early stages of environmental legislation in that it was mainly set up to combat point source emissions" (Kronsel in Anderson and Liefferink 1997, 49). However, environmental policy and institutions evolved over time to approach environmental protection from a "more holistic manner" reflecting the tenants of sustainable development included in the 1987 *Brundtland Report* (Molin 1999). In 1976, the Swedish Environmental Protection Agency was established and in 1987 a separate Environment and Energy Ministry was formed. It is important to note that Sweden's primary environmental ministry was established before it became a member of the European Union, unlike Greece and Portugal which did not have national environmental ministries before their entry into the EU.

Sweden is also considered to be a 'leader' in environmental policy within the European Union (Molin 1999; Anderson and Liefferink 1997) and prior to their entry into the European Union in 1995; concerns over environmental standards played a large role in the debate over membership. "There was a widespread fear in the 'no' camp that Sweden would be forced to lower its environmental standards when joining the Community, and would not be able to continue pursuing an international environmental leadership role as an EU member" (Molin 1999, 244). Once a member of the EU, Sweden worked to improve overall environmental quality standards and had particular success in several areas in the 1990s, including acidification, the Intergovernmental Conference, and the Auto/Oil Programme (Molin 1999). "Instead of taking a strong defensive stance on issues of national importance, Sweden has chosen to try to persuade

fellow Member States of the necessity for strict EU environmental standards by combining role-model tactics with active lobbying within the Community" (Molin 1999, 251). Trying to establish an environmental consensus in line with their political culture of shared decision-making while serving as an example of the way forward Sweden has been able to maintain relatively high levels of environmental protection domestically while trying to establish more stringent measures throughout the EU that will, in turn improve their domestic pollution issues further, particularly in regard to acid rain. "Swedish policy-makers believed that if Sweden could not set an example, it would have no grounds on which to argue that other countries should work towards reducing the sulphur content of fossil fuels" (Kronsel in Anderson and Liefferink 1997, 44). Given these preferences for being a positive leader in environmental policy it is not surprising that Sweden also has one of the best records of compliance to existing EU environmental regulations. Between 1995 and 2004 only 55 actions were taken against Sweden for non-compliance with EU environmental regulations, the second best record among the EU 15 (Camyar 2007).

A partial explanation for Sweden's preference for stringent environmental policy stems from their decades of struggle with transboundary air pollution from other European countries contributing to acid rainfall on Swedish soil. Acid rain is caused primarily by emissions of sulfur dioxide and nitrogen oxides. "Swedish scientists found that between 1962 and 1996 the wind-borne pollutants had increased the acidity of rainfall by a factor of eight. Swedish soil is low in calcium and as a result the Swedish ecosystem was particularly sensitive to acidification, with much damage being done to forests, lakes and rivers" (Barnes and Barnes 1999, 26). The Swedish government took action to reduce domestic sources of pollution "by banning the burning of high-sulphur oils in 1969" (26). However, domestic sources were not the only or even

the primary contributor to Sweden's acid rain problem and "evidence accumulated that wind-borne sulphur dioxide and nitrogen oxide could be carried over long distances. As a consequence of the prevailing wind direction, the source of much of the pollution affecting Sweden came primarily from the UK, Germany and Poland"(27).Since most of the pollution was being emitted in other European countries, Sweden had incentives early on to encourage international and transnational cooperation to reduce pollutants. Currently, Sweden continues to face environmental problems including the continued effects of acid rain, pollution in the Baltic and North Seas[21] and a desire to continue to reduce greenhouse gases and adapt to the potential effects of climate change.

The Green Party in Sweden has been relatively successful and by the 1982 and 1985 elections had gained seats on many municipal councils (Bennulf and Johnsson 1993, 30), and in 1988 the Green Party members were elected to the national parliament. (Kronsel in Anderson and Liefferink 1997, 51). In the October 2010 election[22] the Green Party won 25 out of 349 total seats in the legislature or 7.3 percent of the vote share. This was up from the previous vote share in the 2006 election where the Greens won 19 seats. In the June 2009 European Parliament elections the Green Party won 11percent of the vote share capturing 2 out of 18 seats. Though the Green Party is relatively well represented in Sweden it was never a member of the ruling coalition between 2005 and 2010.

Energy

Current Energy Use. Sweden is a leader in the production of renewable resources in Europe and is second only to Germany in the production of electricity from renewable energy producing an average of 76.745 billion kilowatt hours (kWh) per capita annually from 2005-

[21] CIA World Factbook, available at: https://www.cia.gov/library/publications/the-world-factbook/geos/sw.html
[22] Elections results from http://www.parlgov.org

2010. Renewable energy in Sweden is generated from primarily from biomass (11387 Thousand toe[23]) and hydropower (5709 Thousand toe) but also from wind (301 Thousand toe) and solar (11 Thousand Toe).[24] Sweden also relies less on fossil fuels in its total energy consumption and electricity generation than the EU average and produces relatively low amounts of oil (3.899 thousand barrels per day per capita average annually from 2005-2010[25]). The Swedish are less dependent on fossil fuels than some Member States because of their reaction to the Oil Crisis and due to progressive climate and energy policies. “The oil embargo created an oil crisis in Sweden, and the most important concerns became the dependence on fossil fuel and Sweden’s subsequent vulnerability to external politics” (Kronsel in Anderson and Liefferink 1997, 44). In response, Sweden introduced energy conservation policies and “various types of research projects and initiatives aimed at developing alternative energy sources were initiated. Energy conservation methods and insulation techniques were encouraged by governmental funds and subsidies. In addition, petrol was rationed; television transmission was stopped at 10 p.m.” (Kronsel in Anderson and Liefferink 1997, 45). Sweden also introduced a tax on energy use for steel producers encouraging the industry to become more energy efficient. (Anderson and Liefferink 1997, 33). As of 2009, 58 percent of electricity in Sweden is generated from renewable sources, while only 2 percent is generated from oil and coal. Though there was a ban on nuclear energy in Sweden in 1979, that ban was later lifted, partially to reduce carbon emissions. In 2009 38 percent of electricity generated was from nuclear power.

Potential for Renewable Energy. Sweden has one of the highest potentials for Wind energy development in Europe. According to the EEA, Sweden’s potential for offshore wind

[23] Ton of oil equivalent
[24] Data is for 2010 and available at: http://epp.eurostat.ec.europa.eu/guip/mapAction.do?indicator=ten00082_2&mapMode=dynamic&mapTab=1
[25] Data available at http://www.eia.gov/countries/

production is relatively average at about 1,000 terawatt hours (TWh). However, Sweden has the second highest unrestricted technical potential for onshore wind energy in Europe after France with over 5,000 TWh of technical potential. Development potential for solar, or photovoltaic, energy is somewhat lower.[26] Northern Europe receives much less annual sunshine than southern Europe. However, though there is less potential than in the south, Sweden is already generating some solar energy and could expand production.

Vulnerability to Climate Change

Currently, southern Sweden has a generally temperate climate and the south and a subarctic climate in the north. The terrain is mostly flat to hilly with mountains in the western portion of the country.[27] Sweden already experiences some annual coastal and inland flooding, and without any plans for implementing adaptation strategies, it is expected to increase into the future.[28] Though there is potential for increased flooding, it is not as severe as in other parts of Europe like the United Kingdom, southern Greece, Latvia, parts of northern Germany, and the island of Sicily in Italy. Increases in temperature can also contribute to potential increases in human health hazards. Sweden may experience some increases in heat-related mortality, though projected increases would me much lower than in other parts of Europe, particularly Portugal. Sweden could also experience an increase in certain disease vectors as warmer temperatures expand potential ranges of species like *Aedes albopoctus*, a species of mosquito that can be a carrier of several viruses including Chikungunya. Though *Aedes albopoctus* is not currently present in Sweden, projections show that by 2030, temperature changes could lead to areas

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[26] See http://re.jrc.ec.europa.eu/pvgis/cmaps/eur.htm for maps of solar radiation and photovoltaic energy potential in Europe.
[27] See https://www.cia.gov/library/publications/the-world-factbook/geos/sw.html
[28] See http://www.eea.europa.eu/data-and-maps/indicators/coastal-areas/coastal-areas-assessment-published-sep-2008 for a map of projected flooding.

around the southern coast of the country becoming more suitable habitat for the mosquito (EEA 2008a).

According to the European Environment Agency, Sweden has already begun to experience temperature changes due to anthropogenic climate change. Annual mean changes range between 0.6 and 1.2 °C per decade[29] between 1976 and 2006. This observed warming was most pronounced in the winters with average temperatures increasing 0.6-2 °C per decade during the same time period. This is the most pronounced warming of any region in Europe. This warming trend is expected to increase into the future. IPCC models suggest that Sweden is likely to experience a change in mean temperature between 1980-1999 and 2080-2099 of an increase of 3-5 °C. This is the highest projected temperature increase in Europe. Sweden's neighbors, Norway and Finland, are the only other countries that will experience a similarly high projected temperature increase. Sweden has also experienced changes in annual precipitation. Between 1961 and 2006 precipitation increased up to 30 millimeters per decade in some areas of the country. This trend is expected to continue into the future with projected increases in average annual precipitation of 5-20 percent in 2080-2099 as compared to precipitation levels experienced in 1980-1999.

Climate Change Politics and Policy

Sweden has also been a leader in climate change policy. In 1991 Sweden introduced a carbon-energy tax similar to the one later proposed by the European Commission (Anderson and Liefferink 1997). Sweden has already adopted a national adaptation plan to mitigate the potential impact of climate change[30] and between 2009 and 2011 the Swedish government spent 5 billion Krona, or about €5.6 billion, on adaptation policies and planning to reduce the potential impact

[29] See map 5.1 of "Impacts of Europe's changing climate – 2008 indicator based assessment" available at: http://www.eea.europa.eu/publications/eea_report_2008_4
[30] Sweden's National Adaptation Plan is available at: http://www.smhi.se/klimatanpassningsportalen

of climate change.[31] Among some of the national adaptation programs and policies that have already been implemented are GreenClimateAdapt, AQUARIUS, and Climate Strait. GreenClimateAdapt is a program designed to help cities adapt to heat waves and increasing precipitation by adopting green roofs and facades, open storm water management, and other tools.[32] AQUARIUS is an EU funded program that Sweden participates in with Germany, Scotland, Norway, Denmark, and the Netherlands to share information and tools on soil and water conservation between farmers, foresters and landowners in those countries.[33] Climate Strait is a networking based initiative for municipalities with workshops on climate and energy related topics.[34] Sweden is also a part of the Baltic Sea Region Programme 2007-2013 which is a cooperative group of 11 countries around the Baltic Sea designed to improve maritime safety and security, economic development, energy transmission and supply, transportation and the environment in the region. One of the identified priority areas addressed by the program is climate change, particularly adaptation.[35]

Public Opinion on Climate Change. In a special Eurobarometer survey conducted in August and September of 2009 several questions were asked about attitudes towards climate change. Overall, the Swedish view climate change as a very serious problem, do not think enough is being done to combat it, and do not see increased environmental regulations as an obstacle to economic growth. Swedes are the most likely members of the European Union to view climate change as one of the "most serious problems facing the world as a whole" with 75 percent of respondents selecting climate change as a response. This is significantly higher than

[31] See http://www.sweden.gov.se/sb/d/5745
[32] See http://www.malmo.se/ for more information on GreenClimateAdapt
[33] See http://www.smhi.se/klimatanpassningsportalen for more information and links on the AQUARIUS project.
[34] See http://www.klimasundet.net/svensk.html for more information on Climate Strait
[35] See http://climate-adapt.eea.europa.eu/web/guest/transnational-regions/baltic-sea and http://eu.baltic.net/ for more information on the Baltic Sea Region Programme

the responses to the same question from the EU as a whole, only 47 percent of all respondents selected climate change. When asked about the severity of the issue, sixty-eight percent of Swedish respondents replied that climate change is a “very serious problem”. Sixty-eight percent of respondents felt the EU was “not doing enough to combat climate change” while 24 percent felt that the EU was “doing the right amount”. Fifty-nine percent of respondents felt that the Swedish government was not doing enough while 34 percent felt the government was doing the right amount. Seventy percent of Swedes think that corporations and industry are “not doing enough to fight climate change” while only 24 percent felt they were “doing the right amount”. The Swedish also see climate change both as an issue that can be solved, and that investing in environmental protection is good for the economy and would not hinder growth. Seventy-five percent of respondents agreed that environmental protection could boost economic growth and 14 percent disagreed (Eurobarometer 322 2009).

Emissions Reduction Performance under the EU ETS. Sweden has been one of the best performing states in the EU in regard to reducing their CO_2 emissions. Between 2005 and 2010, Sweden had the fourth lowest verified emissions per capita in the EU and ranked 10th in reducing their emissions relative to their EU ETS targets (see Figure 5.1). Sweden has also met its EU ETS targets every year from the beginning of the ETS through 2010 (see Figure 6.1). Though Sweden has been meeting its targets, the total quantity of carbon emissions is still rising overall. In 2005, Sweden’s EU ETS facilities emitted 19,381,682 tonnes of CO_2. In 2010 Sweden produced 22,661,193 tonnes of CO_2.

Though Sweden has seen an increase in emissions from those facilities, the total amount of greenhouse gases (GHGs) produced has fallen (see Figure 6.2). In 2005 the total amount of

GHGs produced in Sweden was 67,591 thousand tonnes of CO_2 equivalent. By 2009 the amount of GHGs produced had fallen to 59,994 thousand tonnes of CO_2 equivalent.

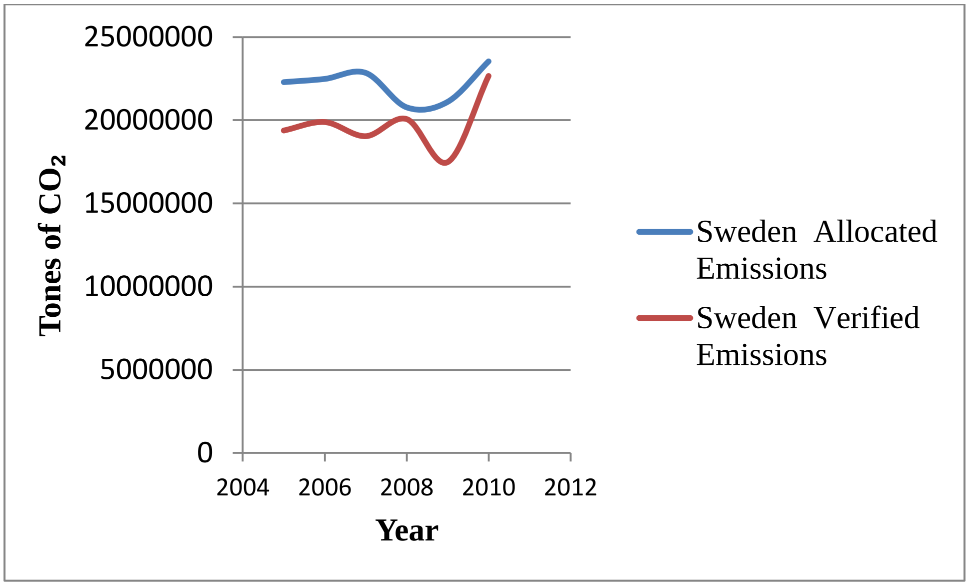

Figure 6.1: EU ETS Emissions Reduction Performance in Sweden

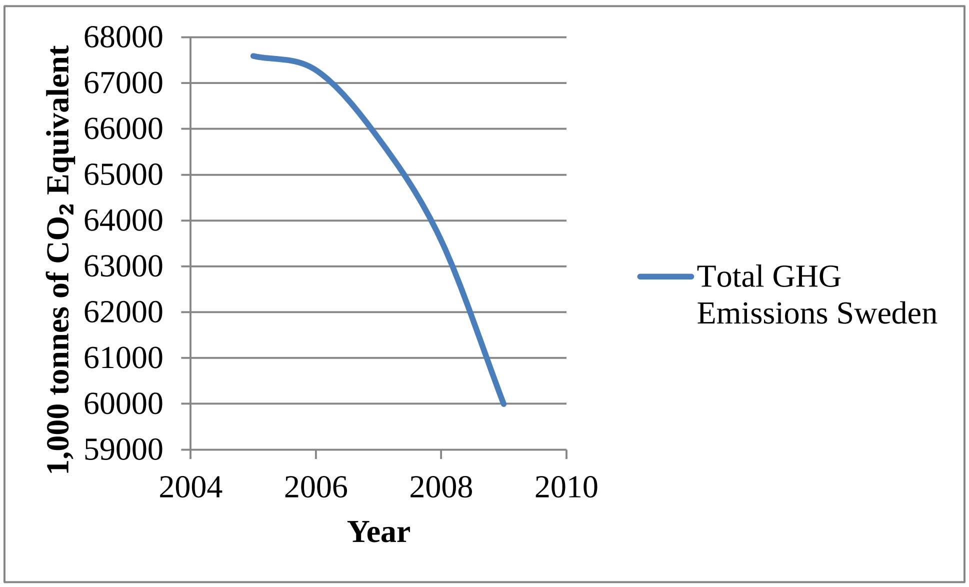

Figure 6.2: Total GHG Emissions in Sweden, 2005-2009

Sweden has also been successful at reducing the amount of CO_2 produced per person in the country (see Figure 6.3). Levels of CO_2 produced per person in the country have declined from 5.9 tonnes per person in 2005 to 5 tonnes per person in 2009. This is also substantially lower

than the average across all 27 EU member states (which was 8.6 in 2005 and 7.5 in 2009). Sweden has been relatively successful at meeting its targets under the EU ETS, as well as reducing their greenhouse gas emissions overall.

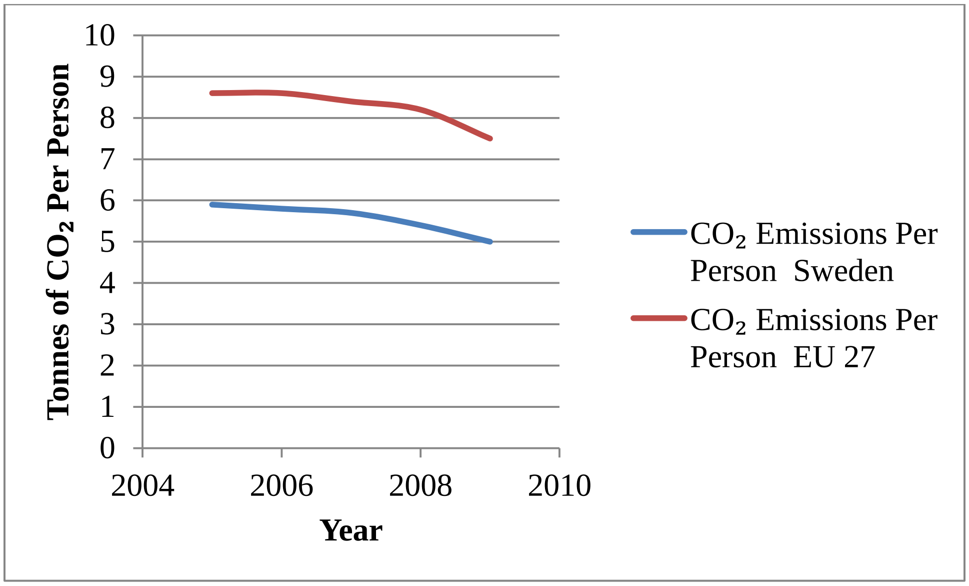

Figure 6.3: CO_2 Per Capita in Sweden and the EU 27, 2005-2009

Chapter 7: Denmark

Introduction

Denmark, like Sweden, is a constitutional monarchy located in northern Europe. The Queen is the ceremonial head of state and the prime minister is the head of government. The Folketing, or parliament, is unicameral and elected using proportional representation. Denmark is unitary, decentralized, consensus style democracy with a similar Nordic tradition of “conciliation and arbitration” as Sweden (Lijphart 1999, 250). Quality of life in Denmark is very high due to relative wealth, health, and quality of government. GDP per capita in 2010 was € 42,200 and average life expectancy at birth was 77 for males and 81 for females (Eurostat). The adult prevalence rate of HIV/AIDS is very low at 0.2 percent of the population, and the adult obesity rate is also low at 11.4 percent of the population. Denmark provides taxpayer-funded universal healthcare to all of its citizens and taxpayer-funded education is provided including university education. The adult literacy rate is 99 percent. Denmark is one of the least corrupt countries in the world, ranking second in 2011, on the Corruption Perception Index with a score of 9.4. Denmark also ranks highly on the Human Development Index and in 2011 it ranked 16th, falling under the category of ‘very high’ human development. Due to the combination of these conditions, Denmark can be viewed as having “postmaterialist values” (Inglehart 1997).

Denmark joined the European Union in 1973, the same year as the United Kingdom and Ireland. In 2000, Danes voted “no” in a national referendum to joining the European Union’s common currency, the Euro, and to maintain the use of the krone. After elections held in November of 2007, the governing coalition was formed by two political parties: the Liberal Party of Denmark, which received 46 out of a total 179 seats in the Folkting, and the Conservatives who received 18 seats. Both parties lean right (7.3 and 7.2 respectively), creating a right leaning government (ParlGov.org).

Environmental Institutions and Past Environmental Record

Denmark has a reputation as acting as an environmental policy leader, and is considered part of the "green troika" (which also included Germany and the Netherlands) that acted to push for stringent environmental regulation in the EU (Molin 1999). Similar to the pattern of development of environmental institutions in the United States, some of the earliest environmental legislation in Denmark was related to water pollution and sanitation. In 1926 the Water Supply Act was passed and in 1949 the Water Course Act was passed, "regulating discharges to all fresh waters" (Anderson and Liefferink 1997, 252). In the 1960s concern over pollution began to increase, leading to the creation of new environmental institutions in the 1970s—a pattern similar to the experiences in the United States and Sweden. In 1971 a new Ministry of Pollution Control was established and in the following year the Hazardous Waste Act was passes. In 1973 the Environmental Protection Act was adopted and established the Ministry of Environment. By the 1980s, however, there were concerns about enforcement and compliance to the new environmental regulations. This led to another round of intense debate on the environment that would lead to the establishment of additional policy. In 1987 the Plan for the Aquatic Environment was introduced and in 1992 the Plan for Sustainable Agriculture was established, but this time also contained "binding guidelines for waste water treatment as well as new restrictions on agricultural practices" (Anderson and Liefferink 1997, 255).

By the early 1990s Denmark was considered by some to be the most environmentally progressive of all the EU member states, but that position started to change later in the 1990s. "Denmark's reluctant attitude towards European integration has tended to make its European environmental policies defensive; Denmark has tended to focus more on opt-outs and guarantees than the attainment of high standards of a common European environmental policy, but at the

same time, wished to maintain its right to be 'cleaner than the rest'" (Anderson and Liefferink 1997, 252). The 1990s also saw a broadening of the types of instruments applied to environmental policy including some that were voluntary and others that were based on economic incentives (Anderson and Liefferink 1997, 257). Denmark initiated policies to reduce their CO_2 emissions in the 1990s with the introduction of the Ministry of Energy's Energy 2000 plan. That plan which included taxes on carbon emissions, improved efficiency standards for appliances, and the increased use of wind energy and natural gas (Anderson and Liefferink 1997, 257).

As of the 2007 parliamentary elections and the 2009 European Parliament elections, the Green Party, De Grønne, was not represented in either the national legislature or the EP. However, the Socialist People's Party, Socialistisk Folkeparti, is an observer party to the European Greens and their two members elected to the European Parliament sit with the Greens.[36] Overall, Denmark does have an exceptional record of compliance to existing EU environmental regulations. Between 1995 and 2004 only 47 formal infringement actions were taken against Denmark for non-compliance, the fewest of any of the EU 15 member states (Camyar 2007).

The Belts and Kattegat sea waters surrounding Denmark do have some problems with pollution from both domestic and transboundary sources.[37] Denmark, unlike Sweden is not greatly affected by acid rain and due to its geology. Layers of lime present in the soil reduce the potential effects of acidification (Anderson and Liefferink 1997, 251). Currently, Denmark still has problems with "air pollution, principally from vehicle and power plant emissions; nitrogen

[36] See http://europeangreens.eu/news/danish-host-party-sf-profile for more information.
[37] See https://www.cia.gov/library/publications/the-world-factbook/geos/da.html

and phosphorus pollution of the Northern Sea; drinking and surface water becoming polluted from animal wastes and pesticides" (CIA World Factbook 2012).

Energy

Current Energy Use. Similarly to Sweden, Denmark was also affected by the oil embargo in the early 1970s and chose to improve the efficiency of their energy use. Denmark was completely dependent on imported oil and coal at the time of the energy crisis, and the government, after some discussion than rejection of the introduction of nuclear power, decided to implement new policies to improve energy efficiency and develop renewable resources. Denmark does however remain predominantly dependent on fossil fuels including coal and oil from the North Sea (Anderson and Liefferink 1997, 254). Denmark is the second largest producer of oil in Europe producing an average of 305.994 thousand barrels of oil per day between 2005 and 2010.[38] In 2009, solid fuels (predominantly coal) are used to generate 48 percent of electricity in Denmark. Renewables account for 28 percent of electricity generation, which is 10 percent higher than the EU-wide average of 18 percent. Most of the renewable energy in Denmark comes from biomass (2424 thousand toe in 2010) and wind (671 thousand toe in 2010). Geothermal energy, hydropower and solar energy are also used.

Potential for Renewable Energy. Denmark has low to average unrestricted technical potential for onshore wind energy, but has the second highest offshore potential in Europe. According to the EEA (2009a), onshore potential is about 900 TWh and offshore potential is just under 3,000 TWh. Potential for the generation of solar energy is present, but not as high as in other areas in Europe that receive more annual sunlight.[39]

[38] Data available at http://www.eia.gov/countries/
[39] See http://re.jrc.ec.europa.eu/pvgis/cmaps/eur.htm for maps of solar radiation and photovoltaic energy potential in Europe.

Vulnerability to Climate Change

Denmark has a temperate climate with mild winters and cool summers. The terrain is mostly low and flat with some hilly areas.[40] Denmark already experiences annual coastal and inland flooding, particularly on the island of Lolland and in parts of Jutland. It is not projected to increase much into the future,[41] possibly because of the existing system of dykes.[42] Temperature changes are projected to increase the likelihood of *Aedes albopictus* expanding its range into Denmark as the habitat becomes more suitable for the disease vector (EEA 2008a).

According to the European Environment Agency (2008b), Denmark has already experienced warming due to anthropogenic climate change. Though not as dramatic as the warming experienced by its northern Nordic neighbors, Norway, Sweden, and Finland, Denmark's temperatures have increased between 0.6 and 1.2 °C per decade between 1976 and 2006. Denmark also experienced precipitation increases of up to 30 millimeters per decade between 1961 and 2006. These patterns of warming temperatures and increasing precipitation are expected to continue into the future. Projections made by the IPCC indicate that temperature is expected to be 2.5-3 °C higher in 2080-2099 than it was in 1980-1999. Precipitation is also projected to increase by 5-10 percent in 2080-2099 as compared to precipitation levels recorded from 1980-1999.

Climate Change Politics and Policy

In 2008, a Commission on Climate Change was created by the Danish government.[43] The Commission is composed of ten scientists charged with the task of coming up with solutions and

[40] See https://www.cia.gov/library/publications/the-world-factbook/geos/da.html
[41] See http://www.eea.europa.eu/data-and-maps/indicators/coastal-areas/coastal-areas-assessment-published-sep-2008
[42] See https://www.cia.gov/library/publications/the-world-factbook/geos/da.html
[43] See http://www.ens.dk/en-US/policy/danish-climate-and-energy-policy/danishclimatecommission/Sider/Forside.aspx

strategies to reduce greenhouse gas emissions as well as how to move towards using more renewable energy sources in place of fossil fuels. Also in 2008, Denmark adopted its National Adaptation Strategy[44] which includes planning and policies across several priority areas: costal management, water, energy, agriculture, forestry, fisheries, urban and regional planning, health, preparedness, buildings and construction, and nature. Denmark also established the Information Centre for Climate Change Adoption which is designed to provide business, citizens, and public authorities information on adaptive strategies. Denmark has established targets such that by 2050, the country's entire energy supply will come from renewable sources.[45] This is especially interesting given that Denmark is one of the largest producers of oil in Europe.

Public Opinion on Climate Change. In a 2009 Special Eurobarometer on climate change 69 percent of Danish respondents felt that climate change is one of the most serious problems facing the world today and 63 percent felt that climate change is a "very serious issue". Fifty-two percent think that the EU is "not doing enough" to combat climate change while 40 percent think that the EU is "doing the right amount". Danes are divided on their attitudes toward the actions of their government on climate change with 48 percent feeling the government is "not doing enough" and 46 percent thinking the government is "doing the right amount". Danes are more likely than citizens of any other EU member state to think that corporations and industry are "doing the right amount" to fight climate change (34 percent), but the majority still think that they should be doing more (61 percent). Most Danes also think that the process of climate change can be stopped (69 percent), while 28 percent think that it is an unstoppable process. Most Danes do not see environmental protection as harmful to economic growth. Seventy-five percent agree that environmental protection can boost growth, while 15 percent disagree.

[44] See http://climate-adapt.eea.europa.eu/countries/denmark
[45] See http://www.ens.dk/en-US/policy/danish-climate-and-energy-policy/danishclimatecommission/Sider/Forside.aspx

Emissions Reduction and Performance under the EU ETS. Given its traditional status as an environmental leader state, Denmark has underperformed in reducing its emissions under the ETS. Denmark ranks 20th out of 27 EU member states, with only seven other countries having higher per capita emissions than Denmark.[46] Denmark also had a poor record in regard to meeting their emissions targets ranking 23rd out of 27. The first year of the trial period of the ETS, 2005, was the only year in which Denmark met its emissions targets.[47] In 2005 Denmark produced 26,475,718 tonnes of CO_2 and in 2010 25,266,343 tonnes of CO_2. While this does represent a decline, the trend has not been a continuous downward one (see Figure 7.1).

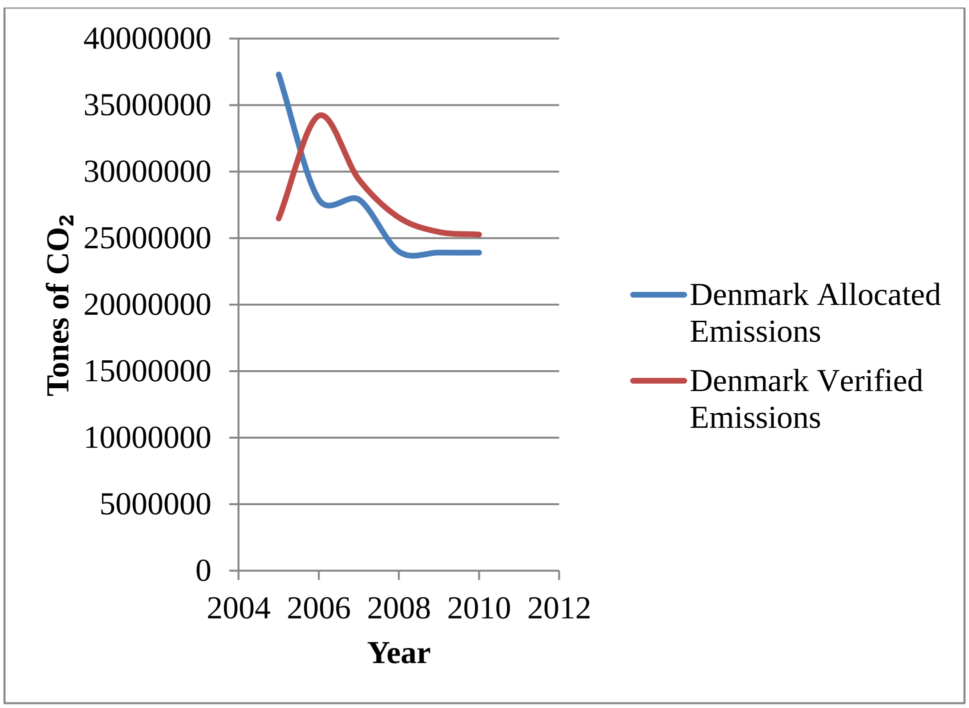

Figure 7.1: EU ETS Emissions Reduction Performance in Denmark

Denmark has experienced a somewhat similar pattern in its overall greenhouse gas emissions, with a decline in total annual emissions since 2005, but a spike in total emissions in 2006.

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[46] See Figure 5.1

[47] See Figure 7.1

In 2005, Denmark produced 63,634 GHGs (in tonnes of CO_2 equivalent), 71,556 in 2006 and 60,985 in 2009 (see Figure 7.2).

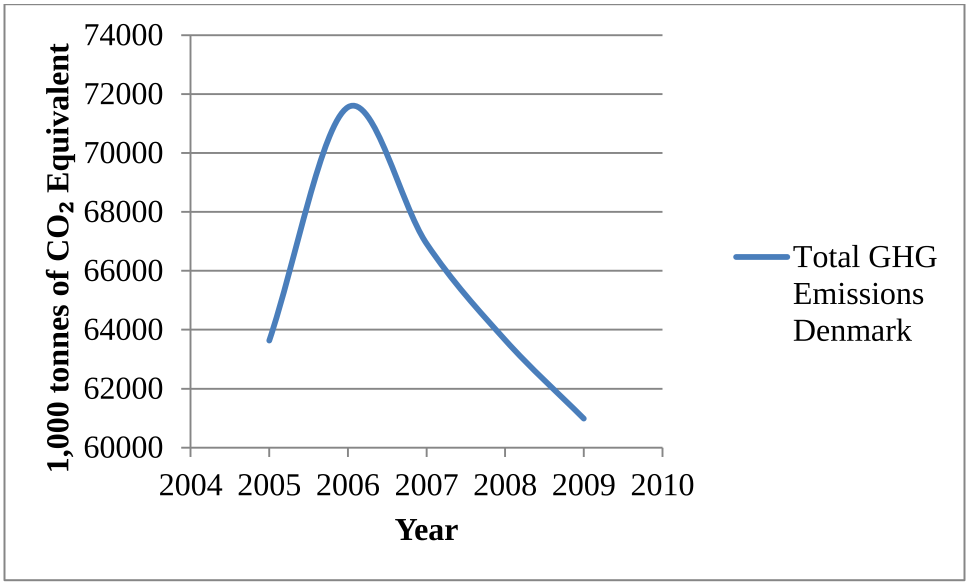

Figure 7.2: Total GHG Emissions in Denmark, 2005-2009

Denmark is also below average in terms of the amount of carbon emissions produced per person in the country (see Figure 7.3). In 2005 Denmark emitted 9.4 tonnes of CO_2 per person in 2005 and 8.8 in 2009. This is substantially above the EU 27 average which was 8.6 tonnes per person in 2005 and 7.5 in 2009. Overall, Denmark seems to be beginning to reduce its carbon emissions, but it is unclear so far if this is a trend that will continue.

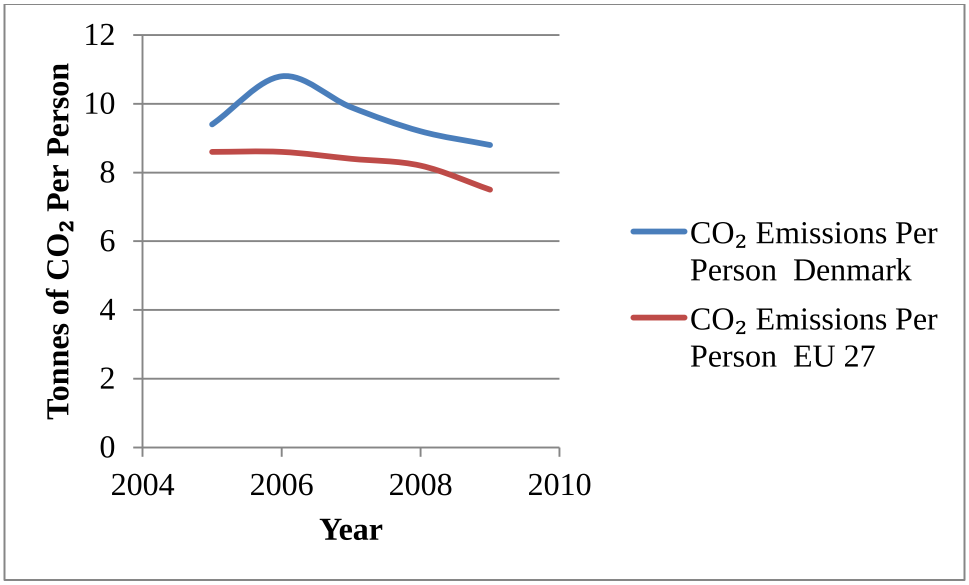

Figure 7.3: CO_2 Per Capita in Denmark and the EU 27, 2005-2009

Chapter 8: Portugal

Introduction

Portugal is a premier-presidential[48] democracy (Duverger 1980; Opello 1985; Bruneau and Macleod 1986; Nogueira 1986; and Schugart and Carey 1992) located in southern Europe, sharing the Iberian Peninsula with Spain. Portugal's democratic government is relatively new and was established after the fall of Marcelo Caetano's previously existing authoritarian regime in 1974. The new constitution was ratified in 1976, creating a unitary and centralized democracy (Lijphart, 1999). The parliament is unicameral and elected using proportional representation. The president is the head of state and the prime minister is the head of government. According to Lijphart, Portugal is a consensus democracy, clustering close to Sweden and Denmark on his Federal-Unitary Dimension and Executive-Parties Dimension (1999, 248). Portugal ranks relatively high on the Human Development Index, ranking 41st in 2011, but has a per capita GDP of € 16,200, which is low relative to Sweden and Denmark. Political corruption is relatively high in Portugal, which has a score of 6.1 on the Corruption Perception Index.[49] This is significantly higher than levels of corruption in Sweden and Denmark (9.3 and 9.4 respectively). Average life expectancy is still very high and in 2010 was 77 for males and 83 for females. Portugal has an adult HIV/AIDS prevalence rate of 0.6 percent and an adult obesity prevalence rate of 14.2 percent. The first 12 years of education in Portugal are compulsory and the adult literacy rate is 94.9 percent.[50]

Portugal became a member of the European Union in 1986, the same year as Spain. Portugal is also a member of the Eurozone, using the Euro as its official currency. Portugal's EU membership also helped to facilitate the consolidation of their newly established democracy and

[48] This type of government is also referred to as semi-presidential
[49] See http://cpi.transparency.org/cpi2011/
[50] See https://www.cia.gov/library/publications/the-world-factbook/geos/po.html

its institutions. This was especially true in the case of regulatory areas like environmental protection where Portugal had "relatively weak economic and administrative capacities to embark upon effective harmonization with EU standards" (Koutalakis and Font 2006, 2). In a national election held in September of 2009, the Socialist Party (left/right score of 4.1) won 97 out of 230 seats in the Assembleia da Republica. The current president, elected in 2006, Anibal Cavaco Silva is a Social Democrat (left right score of 6.2) and former prime minister.

Environmental Institutions and Past Environmental Record

Portugal has been considered an environmental 'laggard' state and prior to its entry into the European Union in 1986 had not yet established a national environmental ministry (Barnes and Barnes 1999; Anderson and Liefferink 1997; Font and Morata 1992). In 1990 the Ministry of the Environment and Natural Resources was established,[51] now called the Ministry for Agriculture, Sea, Environment and Spatial Planning. Contributing to its laggard status is Portugal's record of violating EU environmental policy. Between 1995 and 2004, Portugal had 185 formal infringement actions taken against them for non-compliance. Their record of non-compliance is the fourth worst in the EU 15 with only Italy, Belgium and the United Kingdom having more infringement actions taken against it in the same time period (Camyar 2007). Prior to the mid-1990's the compliance record in Portugal to EU environmental policy was even worse (Koutalakis and Font 2006). The Ecology Party, or Partido Ecologista, does not have much influence in domestic politics. In the February 2005 national elections the Ecology Party won 2 seats out of 230 in the legislature, but lost them in the subsequent election in September of 2009. The Ecology Party did not win any seats to the European Parliament between 2005 and 2010. Currently, Portugal's primary environmental issues are soil erosion, coastal water pollution, and

[51] See http://www.oecd.org/dataoecd/8/35/2451375.pdf

air pollution from industry transportation.[52] Portugal has had some success in reducing sulfur oxides, but still has problems with particulate pollution and ground level ozone in the air.[53]

Energy

Current Energy Use. Thirty-three percent of electricity generated in Portugal in 2009 was from fossil fuels like coal and oil. Twenty-nine percent of electricity was generated from gas. However, renewables provided the largest fuel source used, generating 36 percent of electricity. Biomass and hydropower account for most of the renewable energy produced in Portugal (2994 and 1388 thousand toe respectively in 2010). Wind (790 thousand toe), solar energy (76 thousand toe) and geothermal (190 thousand toe) sources are also utilized. Portugal is not a major oil producing state, producing an average of 5.383 thousand barrels of oil per day between 2005 and 2010 according to the US Energy Information Administration.[54]

Potential for Renewable Energy. Portugal has relatively low to average potential for onshore and offshore wind energy. Combined the unrestricted potential for wind energy is just over 1,000 TWh (EEA 2009a). The Iberian Peninsula is one of the sunniest regions in Europe, particularly southern Portugal which has the some of the highest potential for photovoltaic energy production in Europe.[55] The only other areas with similar potential are small portions of southeast Spain, and the southern portion of the island of Sicily in Italy. Portugal also has additional hydropower potential waiting to be harnessed. According to the OECD, only 46 percent of the country's potential hydropower resources have been harnessed so far.[56]

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[52] See https://www.cia.gov/library/publications/the-world-factbook/geos/po.html
[53] See http://www.oecd.org/document/2/0,3746,en_2649_34307_47487938_1_1_1_1,00.html
[54] Data available at http://www.eia.gov/countries/
[55] See http://re.jrc.ec.europa.eu/pvgis/cmaps/eur.htm
[56] See http://www.oecd.org/document/2/0,3746,en_2649_34307_47487938_1_1_1_1,00.html

Vulnerability to Climate Change

Portugal has a temperate climate. The rolling plains of south tend to be warm and dry while the north is cooler and rainy.[57] Portugal already experiences annual coastal and inland flooding, but it is not projected to increase much into the future.[58] Droughts and pressure on freshwater resources are expected to increase. Water scarcity and drought is already a problem in several river basins in Portugal including the Sado, Vouga, Taugus, Mondego, and Algarve (EEA 2009). Water scarcity will only continue to increase if temperatures rise and rainfall decreases. Portugal is projected to experience significant increases in heat-related mortality due to climate change. The current baseline for heat-related deaths in Portugal is about 6 per 100,000 people. Projections indicate that heat-related mortality could increase to a range of 19.5 to 248 per 100,000 people by 2080 (Dessai 2003; EEA 2008a). Casimiro et al. also suggest that heat-related mortality will increase if adaptive strategies are not taken to minimize this health risk. They also project that increasing temperatures could lead to higher levels of ground-level ozone, creating an increased environmental health risk, and that "higher temperatures may increase the transmission risk of zoonoses that are currently endemic to Portugal, such as leishmaniasis, Lyme disease, and Mediterranean spotted fever" (Casimiro, Calheiros, Santos, and Kovats, 2006, 1950).

According to the European Environment Agency, Portugal has already experienced some increases in annual temperature due to climate change; these changes are most pronounced in the summer and average 0.4-0.6°C per decade between 1967 and 2006. Precipitation has also been decreasing. Between 1961 and 2006 Portugal experienced decreases in precipitation of up to 150 millimeters per decade in some parts of the country. These trends of increasing temperatures and

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[57] See https://www.cia.gov/library/publications/the-world-factbook/geos/po.html
[58] See http://www.eea.europa.eu/data-and-maps/figures/modelled-number-of-people-flooded-across-europes-coastal-areas-in-1961-1990-and-in-the-2080s

decreasing precipitation are expected to continue into the future. Temperatures are projected to increase by 2.5-3.5 percent and precipitation is expected to increase by 10-30 percent from 2080-2099 as compared to levels recorded between 1980 and 1999.

Climate Change Politics and Policy

Portugal's climate and energy policies have been closely related and part of Portugal's success in reducing their carbon emissions is due to changes in their energy supply. Portugal has reduced its dependence on coal and oil, using more natural gas and increasing use of renewables. Portugal also introduced a program to improve energy efficiency and reduce demand for electricity.[59] Portugal was impacted negatively by the global financial crisis that started in 2007. In 2008 and 2009, Portugal's economy entered a recession and part of the government's response included stimulus spending, 18 percent of which was investment renewable energy and smart grid technology.[60]

Portugal adopted a National Adaptation Strategy in 2010 that focuses on developing adaptive strategies, policies, and tools across nine priority areas: territory and urban development, water resources, safety of people and goods, human health, energy and industry, tourism, agriculture, forests and fisheries, coastal areas, and biodiversity.[61]

Public Opinion on Climate Change. In a special Eurobarometer survey conducted in August and September of 2009 several questions were asked about attitudes towards climate change. Overall, more than half of Portuguese respondents thought that climate change is a serious problem. However, they are the least likely members of the European Union to view climate change as one of the "most serious problems facing the world as a whole," with 28 percent of respondents selecting climate change as a response. This is significantly lower than

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[59] See http://www.oecd.org/document/2/0,3746,en_2649_34307_47487938_1_1_1_1,00.html
[60] See http://www.oecd.org/document/2/0,3746,en_2649_34307_47487938_1_1_1_1,00.html
[61] http://climate-adapt.eea.europa.eu/countries/portugal

the responses to the same question from the EU as a whole, where 47 percent of all respondents selected climate change. The response most frequently given by Portuguese to that question was "poverty, lack of food and drinking water" with 75 percent of Portuguese respondents giving that answer. This may also indicate that Portugal may somewhat less post-materialist than Sweden and Denmark. Fifty-three percent of Portuguese respondents replied that climate change is a "very serious problem" when asked about the severity of the issue. This is lower than responses in Sweden (68 percent), Denmark (63 percent), and the EU 27 average (63 percent).

Fifty-three percent of respondents in Portugal felt the EU was "not doing enough" to combat climate change while 22 percent felt that the EU was "doing the right amount". Fifty-nine percent of respondents felt that the Portuguese government was "not doing enough" while 20 percent felt the government was "doing the right amount". Sixty-four percent of Portuguese think that corporations and industry are "not doing enough" to fight climate change while only 15 percent felt they were "doing the right amount". Half of Portuguese respondents think that climate change is not an unstoppable process, and do not think that the problem has been exaggerated. Fifty-eight percent think that fighting climate change can have a positive impact on the economy while only 12 percent disagreed (Eurobarometer 322 2009).

Emissions Reduction Performance under the EU ETS. Portugal has been one of the best preforming member states in the EU in CO_2 emissions reductions, ranking 7th best out of 27 member states. Portugal also ranked 7th in reducing their emissions relative to their ETS targets (see Figure 5.1). Portugal has also met its emissions targets every year from the beginning of the ETS through 2010, successfully reducing emissions each year (see Figure 8.1). In 2005 Portugal's verified emissions from ETS facilities totaled 36,425,933 tonnes of CO_2. In 2010 their total verified emissions from ETS facilities were down to 24,167,190 tonnes of CO_2.

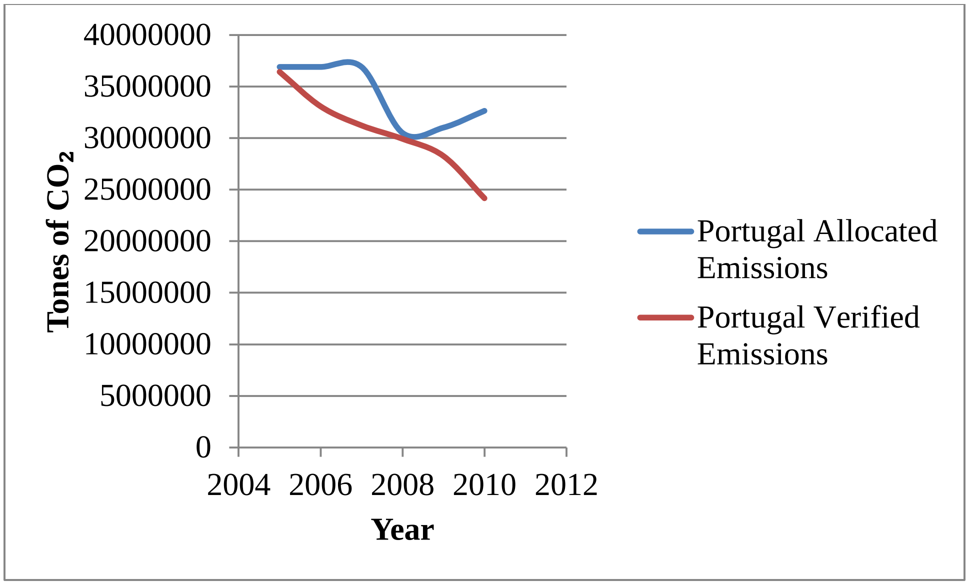

Figure 8.1: EU ETS Emissions Reduction Performance in Portugal

Portugal has also been successful at reducing its total amount of GHG emissions, not just those produced at ETS facilities (see Figure 8.2). In 2005 Portugal produced 85,984 thousand tonnes of CO_2 equivalent. By 2009 the amount of GHGs produced in the country fell to 74,583 thousand tonnes.

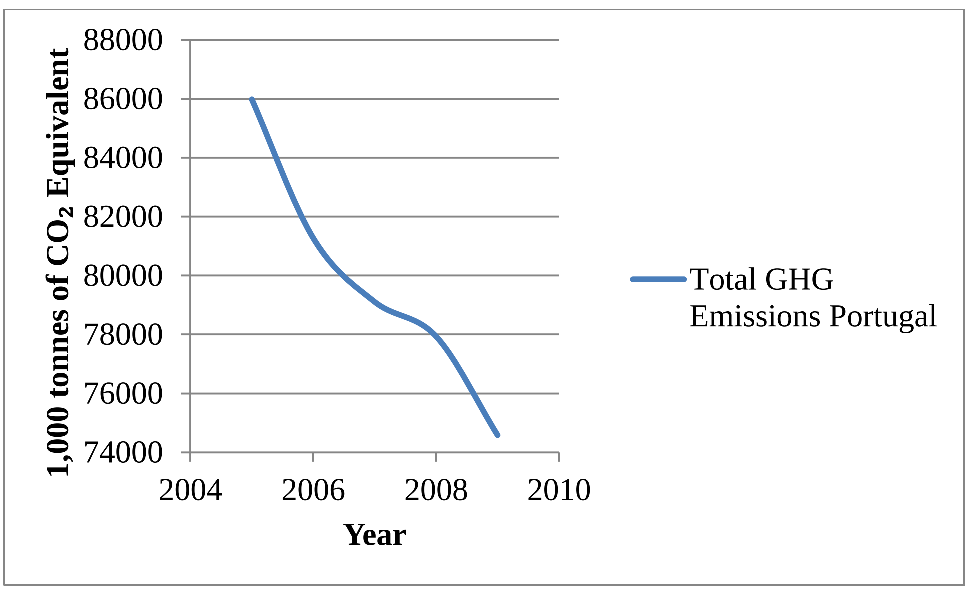

Figure 8.2: Total GHG Emissions in Portugal, 2005-2009

Portugal has also succeeded in reducing its total amount of CO_2 relative to the total population, from 6.4 tonnes of CO_2 per person in 2005 to 5.3 in 2009. This has been a steady, annual decrease each year in that time period. Portugal has substantially been out-preforming the average for the EU 27 on this measure. In 2005 the EU average was 8.6 and in 2009 it was 7.5.

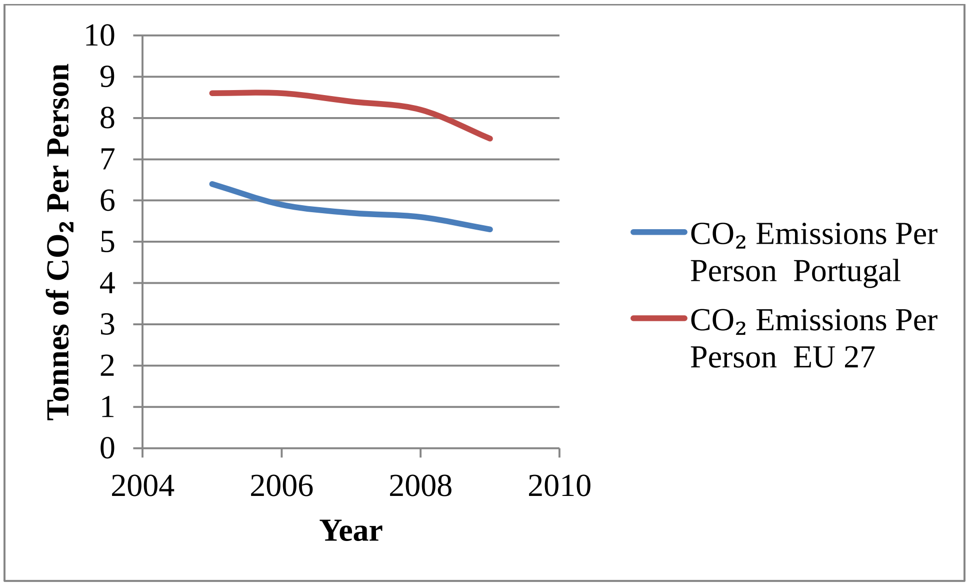

Figure 8.3: CO_2 Per Capita in Portugal and the EU 27, 2005-2009

Overall, Portugal has been more successful than one might anticipate at reducing its emissions from EU ETS facilities and meeting its targets and reducing its overall emissions of GHGs given its traditional status as a policy laggard state. Portugal also has lower levels of CO_2 emissions per person than Denmark (a traditional leader state), Greece (another traditional laggard) and the EU 27 average. Portugal's success may be mostly due to the relatively high amounts of renewable energy utilized in the country. Thirty-six percent of all electricity generated comes from renewable energy. If that same amount of electricity was generated by coal plants its emissions levels would be higher since carbon emissions from coal power plants are regulated under the ETS. If Portugal is able to replace its coal plants with electricity from renewable sources it will see a continued trend of emissions reductions.

Chapter 9: Greece

Introduction

Greece is a unitary, centralized parliamentary democracy (Lijphart 1999). The president is the head of state and elected by the parliament and the prime minister is the head of government. The legislature, Vouli, is unicameral, has a total of 300 seats and is elected using proportional representation. Though Greece has a parliamentary system that uses proportional representation, it falls closer to majoritarian than consensus democracy due to its "impure" PR system (Lijphart 1999). Quality of life in Greece is relatively high but political corruption and financial instability have become increasingly problematic for this EU member state. Greece ranks 29th on the Human Development Index, above Portugal, but below Sweden and Denmark, falling into the category of "very high human development".[62] GDP per capita was €20,400 in 2010. Life expectancy is high at 78 for men and 83 for women, which is comparable to life expectancy in Sweden, Denmark, and Portugal. Adult HIV/AIDS prevalence rates are low at 0.1% of the population, but obesity rates are among the highest in Europe, second only to the United Kingdom.

Political corruption levels are very high in Greece, which received a 3.4 on the Corruption Perception Index[63], and is one of the most corrupt in the EU. Bulgaria is the only member state with higher levels of corruption as measured by the CPI. All levels of education are tax-payer funded, and the first nine years are compulsory. The adult literacy rate is 97.5 percent.[64] Greece joined the European Union in 1981 and as a member of the European Monetary Union uses the Euro as its currency. In elections held in October of 2009 the

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[62] See http://hdr.undp.org/en/statistics/hdi/
[63] See http://cpi.transparency.org/cpi2011/
[64] See https://www.cia.gov/library/publications/the-world-factbook/geos/gr.html for health and education statistics.

Panhellenic Socialist Movement captured 160 seats in the Vouli and formed a left leaning (left/right score 4.3) cabinet lead by George Papandreou.[65]

Environmental institutions and past environmental record

Greece is considered a 'laggard' in environmental policy and prior to its entry into the EU did not have an environmental ministry. (Pridham et al. 1985; Anderson and Lieffrink 1997; Barnes and Barnes 1999). Just before its entry into the EU, Greece created the Ministry for Planning, Housing and the Environment on March 14, 1980, the first Greek ministry established to regulate the environment. Greece restructured its environmental ministry in 1985 combining it with the Ministry for Public Works to create the Ministry for the Environment, Spatial Planning and Public Works (Heinelt and Smith 2003). Though Greece created an environmental institution, that ministry did not have sole authority for making environmental policy, sharing that authority with other ministries (including the Ministry of Agriculture, Marine Commerce and others). This led to "the lack of effective coordination mechanisms, that has led some European analysts to characterize the Greek environmental ministry as a "weak" one (Getimis, Giannakourou, and Dimadma 2003, 153). In 2009 Greece again reorganized its environmental ministry, creating the Ministry of Environment, Energy, and Climate Change. Greece continues to have problems due to weak and disorganized institutions and problems with capacity, enforcement and compliance.[66]

Greece has an average record of past compliance to existing EU environmental regulations and between 1995 and 2004 had 157 actions taken against it for infringement, the 7th highest in the EU 15 (Camyar 2007). In the October 2009 national parliamentary elections the Ecologist Greens, Oikologoi Prasinoi, received 2.5 percent of the vote share, but no seats. In

[65] See www.parlgov.org
[66] See http://www.oecd.org/dataoecd/23/17/44726277.pdf

elections to the European Parliament in June of the same year they were able to capture 3.5 percent of the vote share and one of 22 seats.

Among the current environmental problems Greece faces are water scarcity due to poor management and air pollution. Currently levels of nitrogen oxides and sulfur oxides are some of the highest in all OECD countries[67] and emissions of both continue to increase. Nitrogen oxides contribute to the formation of ground level ozone, an environmental health hazard.[68] Optimal conditions for the formation for ground-level ozone tend to occur in warmer summer months, and if Greece experiences increasing temperatures that could create increased problems with ozone. Greece already has problems with high levels of ozone, and they could increase. Greece also has high levels of particulates in its air, which can also lead to environmental health problems. These problems have already been difficult to tackle in a country with weak environmental institutions and difficulties with enforcement and compliance. The current financial crisis in Greece has only lessened still further the capacity of the state to deal with them.[69] Debt problems in Greece have grown so large that there have been serious questions about whether or not Greece will be able to stay in the Eurozone.

Energy

Current Energy Use. More than half of the electricity in Greece (55 percent) is generated from solid fuels like coal. The rest of electricity production is from petroleum (13 percent), gases (18 percent) and renewables (13 percent). Greece produces less renewable energy per capita than Sweden, Denmark, and Portugal. Most of the renewable energy produced in Greece is from biomass and hydropower (887 thousand toe and 641 thousand toe in 2010, respectively). Geothermal energy, solar power, and wind are also sources of renewables utilized.

[67] See www.oecd.org/dataoecd/23/17/44726277.pdf
[68] See http://www.epa.gov/glo/basic.html
[69] See www.oecd.org/dataoecd/23/17/44726277.pdf

Greece is not a major oil producing state. Between 2005 and 2010, Greece produced and average of 6.308 thousand barrels of oil per day.[70]

Potential for Renewable Energy. Wind energy potential is relatively low in Greece, and very similar to the potential in Portugal. Greece has an unrestricted technical potential for onshore wind energy of just over 500 TWh. Offshore potential is also just over 500 TWh (EEA 2009a). Southern Europe in general is sunnier than northern Europe. Greece has good potential for the generation of solar energy;[71] significantly higher than that in Denmark and Sweden, but not quite as high as Portugal.

Vulnerability to Climate Change

Greece has a temperate climate characterized by hot dry summers and mild rainy winters.[72] Greece already experiences annual inland and coastal flooding. Without taking any adaptive measures to reduce the risk of flooding, it is expected to increase drastically in Greece, particularly in the southern portions of the country. Coastal and inland flooding projections for Greece in 2080 are among the most severe in Europe.[73] According to the European Environment Agency, Greece has already experienced changes in annual temperatures due to anthropogenic climate chance, with all regions experiencing some warming on average across all regions (between 0.2 – 0.6 °C per decade between 1976-2006), with the southwest experiencing pronounced warming in the summer, and some northern areas near Macedonia experiencing cooling in the winter. Greece also experienced changes in average precipitation, seeing decreases of up to 120 millimeters per decade between 1961 and 2006. These trends of increased warming and decreased precipitation are expected to continue into the future. Annual temperatures are

[70] Data available at http://www.eia.gov/countries/
[71] See http://re.jrc.ec.europa.eu/pvgis/cmaps/eur.htm
[72] See https://www.cia.gov/library/publications/the-world-factbook/geos/gr.html
[73] See http://www.eea.europa.eu/data-and-maps/figures/modelled-number-of-people-flooded-across-europes-coastal-areas-in-1961-1990-and-in-the-2080s

projected to be 3-4 °C higher and precipitation is expected to be 15 percent – 30 percent lower between 2080-2099 than in1980-1999.

Current Climate Change Policy

In 1999 Greece adopted a National Climate Change Program. A second was adopted in 2002 and revised in 2007. The current program includes plans to reduce GHG emissions by reducing dependence on fossil fuels, increasing the use of renewable energy, and improving energy efficiency.[74] Greece has not yet adopted a National Adaptation Plan[75] to develop strategies and tools to minimize the potential negative effects of climate change.

Public Opinion on Climate Change. In a 2009 Special Eurobarometer on European's attitudes toward climate change 71 percent of Greek respondents felt that climate change is one of the "most serious problems facing the world" today. After Swedes, Greeks were the second most likely to respond with that answer. The average percentage of respondents across the whole EU was 47 percent answering that climate change was one of the "most serious problems facing the world". Greeks were more likely than any other citizens in the EU to respond that climate change is a "very serious issue" (84 percent). Sixty-seven percent think that the EU is "not doing enough" to combat climate change while 29 percent think that the EU is "doing the right amount". Greeks were the most likely to think that their government is "not doing enough" to combat climate change while only 13 percent of respondents felt the government was "doing the right amount". Greeks also overwhelmingly responded that they felt that corporations and industry are "not doing enough" to combat climate change (94 percent) while only 4 percent felt they were doing enough. Greeks were more likely than any other citizens in Europe to respond this way.

[74] See http://www.eea.europa.eu/soer/countries/gr/climate-change-mitigation-national-responses-greece
[75] http://climate-adapt.eea.europa.eu/web/guest/adaptation-strategies

While most Greek respondents were pessimistic about the amount being done about climate change and feel that it is a very serious problem, they are the most optimistic in Europe that it is not an unstoppable process. Only 18 percent of Greeks agreed that “climate change is an unstoppable process, we cannot do anything about it,” while 81 percent disagreed, thinking that climate change can be slowed or prevented. They also think that money spent on fighting climate chance is well spent and that spending could even have a positive effect on the European economy. Seventy-three percent of respondents agreed that fighting climate change can have a positive impact on the economy. Eighty percent of respondents even felt that it could boost growth which significant during the current economic downturn the country is currently in and the types of austerity measures other governments have been taking.

Emissions Reduction Performance under the EU ETS. Greece has been one of the worst performing member states in the EU under the ETS (see Figure 5.1). They rank 23rd out of 27 in total verified per capita CO_2 (only Cyprus, Finland, the Czech Republic, and Estonia had higher per captia emissions between 2005 and 2010). Greece also ranks 22nd out of 27 in how well they met their emissions reduction targets. Greece failed to meet its ETS targets 2005, 2007, 2008 and 2009, but did meet their emissions targets in 2006 and 2010. Overall, however, the trend has been a downward one. In 2005 Greece emitted 71,267,752 tonnes of CO_2 from ETS facilities and by 2010 it was emitting 59,939,996 tonnes of CO_2 (see Figure 9.1).

Though Greece has had a poor record in reducing their ETS emissions, they have been successful in reducing their total GHG emissions between 2005 and 2009. In 2005 they produced 134,356 thousand tonnes of CO_2 equivalent and in 2009 they produced 122,543 thousand tonnes (see Figure 9.2).

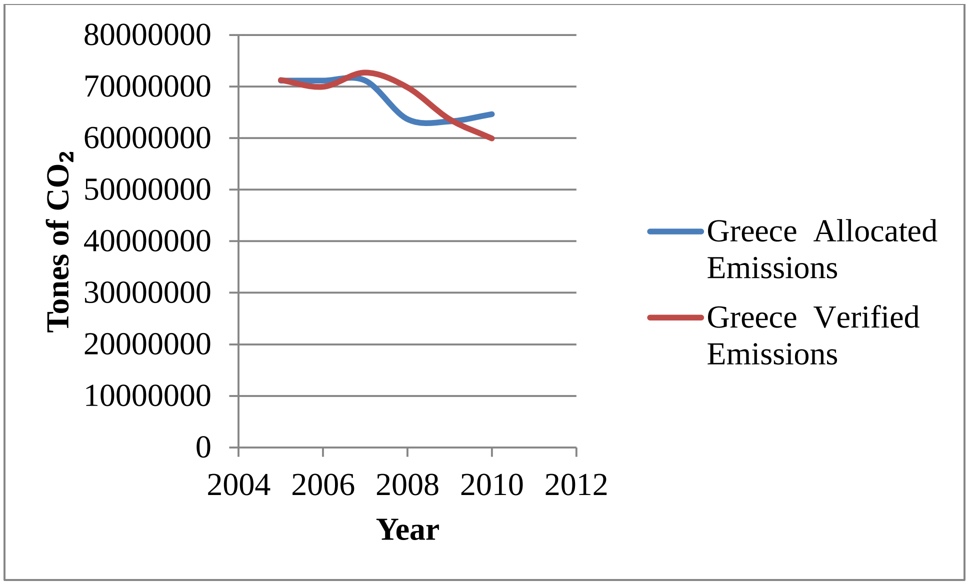

Figure 9.1: EU ETS Emissions Reductions Performance in Greece

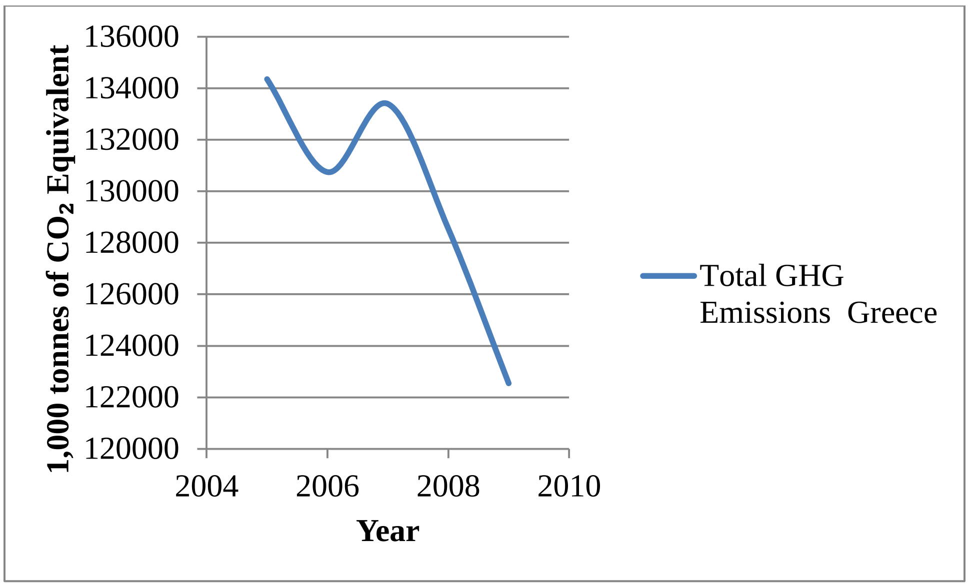

Figure 9.2: Total GHG Emissions in Greece, 2005-2009

Greece has also had some success reducing the amount of carbon dioxide it is emitting per person, but it is still significantly higher than the EU average. In 2005 Greece produced 10.2 tonnes of CO_2 per person and in 2009 it produced 9.3 tonnes per person. The average amount across all EU member states was 8.6 tonnes in 2005 and 7.5 tonnes in 2009 (see Figure 9.3).

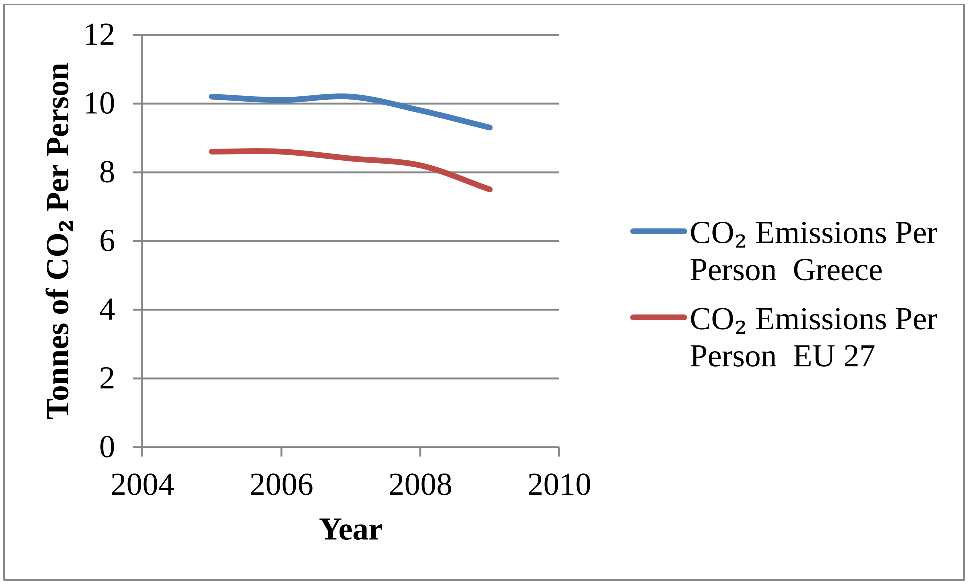

Figure 9.3: CO_2 Per Capita in Greece and the EU 27, 2005-2009

Chapter 10: Discussion and Conclusions

Statistical Model Results

The statistical models presented in chapter 4 yielded the following results: In the first model examining verified CO_2 emissions per capita (see Table 4.2), Corruption, Renewable Energy, Cabinet Ideology, Length of Membership, GDP, Post-Communist, and Length* Corruption all have statistically significant effects. The effect of Corruption is opposite of the direction predicted, with higher levels of corruption correlating to lower levels of verified emissions. Renewable Energy is also significant, and as domestic production of renewable energy increases, emissions decrease. Cabinet Ideology is significant, and as government ideology moves to the right, emissions increase. Length of Membership was also significant, indicating that the longer a country was a member of the EU, the higher their verified emissions. Higher GDPs were associated with higher verified emissions, and post-communist countries were more likely to reduce their verified emissions.

In Model 2 (see Table 4.3), Past Infringement, Corruption, Renewable Energy, Oil Production, Length of Membership, and Length*Corruption all have statistically significant effects. Higher rates of past infringement are associated with lower levels of verified emissions. Renewable Energy, consistent with effects seen in Model 1, is significant. Increasing the amount of electricity generated from renewable energy is associated with lowering verified emissions. Oil production had surprising significant effects, opposite of the hypothesized direction, with increasing production associated with reduction of emissions. Corruption, Length of Membership and Length*Corruption again were all significant. The independent effect of corruption indicates that countries that are more corrupt are better at reducing emissions, and the independent effect

of Length of Membership suggests that countries that have been in the EU longer tend to have higher emissions.

In Model 3 (See Table 4.4), Corruption, Renewable Energy, Oil Production, Length of Membership, and Length*Corruption all have statistically significant effects. It is important and interesting to note that Corruption, Renewable Energy, Length of Membership, and Length*Corruption all have significant effects that are in the opposite direction as their effects on verified emissions in Model 1 and Model 2. Higher levels of oil production are surprisingly associated with increased likelihood of meeting emissions targets.

In Model 4 (see Table 4.5), only Renewable Energy and Green in EP had significant effects. Higher levels of renewable energy production are surprisingly associated with a decreased likelihood of meeting targets. The effect of Green in EP was as predicted, and as the number of green party representatives in the European Parliament increases, so does the likelihood of meeting emissions targets.

Case Study Results and Comparisons

The case study analyses further examined the performance of Sweden, Denmark, Portugal and Greece in reducing their CO_2 emissions from facilities included in the EU ETS. Table 10.1 compares the cases against each other across the statistically significant variables from the OLS and Logit models in chapter 4.

Corruption and Length of Membership. Given that Sweden and Denmark are both low in governmental corruption, and Portugal and Greece have relatively high levels of corruption, but they do not group similarly in regard to emissions reduction performance, the effect of corruption is unlikely to be as simple as more corruption leading to better emissions related performance. In fact, some newer member states may have incentive to perform better on their

emissions targets, and may also be given targets that are easier to meet, or are more lenient in the first place. In the case of Greece, it seems that the combination of weak environmental institutions combined with high levels of corruption and current economic troubles are contributing strongly to their record of poor performance under the ETS.

Table 10.1: Case Comparison across Statistically Significant Variables*

	Sweden	Denmark	Portugal	Greece
Past Infringement	55	47	185	157
Corruption	9.2	9.4	6.2	4.2
Renewable Energy	76.745	10.144	14.491	6.165
Oil Production	3.899	305.994	5.383	6.308
Cabinet Ideology	5.71	7.22	4.14	5.99
Year of EU Membership	1995	1973	1986	1981
GDP	€34,883	€40,867	€15,667	€19,850

*Corruption is the average Corruption Perception Index value from 2005-2010; Renewable Energy is the average amount of renewable energy produced per capita between 2005 and 2010 in tonnes of CO_2; Cabinet Ideology is an aggregate score of all governments in a ruling coalition between 2005-2010. If multiple governments were in power during that time period, it is an average of those scores once multiplied by the number of years in power. Oil production is an average value of production between 2005-2010 in thousands of barrels per day, per capita. GDP is a per-capita value.

In the statistical models, Length of Membership, Corruption, and Length*Corruption all reach statistical significance, and the direction of their effects is opposite for verified emissions and meeting targets. Clearly, the combined effect of corruption and length of membership is important, but so are the independent effects of these variables. However, the mechanisms why still seem unclear. Newer member states are also much more likely to be corrupt, and are more likely to be post-communist. Newer member states also tend to have much lower per-capita

GDPs. These factors are controlled for in the models, so it seems likely that there may be some other variables influencing this relationship that are not well captured by the models.

Table 10.2 compares all 27 member states against the year they joined the EU, their levels of corruption and their rank relative to other member states in their levels of verified emissions per person of CO_2 from ETS facilities, and how well they are meeting their emissions targets. A higher ranking on verified emissions represents the lowest per person emissions, and therefore better performance. A higher ranking on targets represents better performance in meeting ETS emissions targets. A large disparity between the two, when performance on meeting targets is high, but the ranking on verified emissions is low, may indicate that a state has lenient targets. By examining the difference between verified emissions and targets, I found that most of the member states with the largest disparities between these two different indicators of performance in emissions reduction had entered the EU relatively recently, in 2004. From the table, another somewhat rough pattern emerges in that the newest member states, those who entered in 2007 and 2004, are more likely to have higher levels of corruption than states entering the EU in 1995 or earlier. More research is needed to understand the relationship between corruption and length of membership as it affects both verified emissions reductions and meeting emissions targets.

Cabinet Ideology. Cabinet ideology may have some effect in the cases, but has mixed effects in the statistical models. Only in Model 1, which includes the EU 27, does Cabinet Ideology have a statistically significant effect indicating that left-leaning governments are associated with reducing emissions. In terms of meeting targets, the statistical models do not suggest that cabinet ideology plays a role. The cases indicate that those countries that are both reducing emissions and are meeting their targets are the ones with the most left-leaning

Table 10.2: Corruption and Emissions Performance in the EU 27

Year of Membership	Corruption	Verified Emissions	Targets
2007 Enlargement countries			
Bulgaria	3.8	15	14
Romania	3.7	6	3
2004 Enlargement countries			
Cyprus	5.9	24	19
*Czech Republic**	*4.8*	*26*	*4*
Estonia	*6.6*	*27*	*13*
Hungary	5.1	5	11
Latvia	4.6	1	15
Lithuania	4.8	2	8
Malta	5.9	16	18
Poland	*4.4*	*21*	*2*
Slovakia	4.6	13	5
Slovenia	6.5	12	20
1995 Enlargement			
Austria	8.2	10	16
Finland	*9.3*	*25*	*12*
Sweden	9.2	4	10
1986 Enlargement			
Portugal	6.2	7	7
Spain	6.5	9	24
1981 Enlargement			
Greece	4.2	23	22
1973 Enlargement			
Denmark	9.4	20	23
Ireland	7.7	14	21
United Kingdom	8.1	11	27
1952 Founding Members, European Coal and Steal Community			
Belgium	*7.2*	*18*	*6*
France	7.1	3	1
Germany	8.0	22	26
Italy	4.7	8	25
Luxembourg	8.4	19	17
Netherlands	8.8	17	9

*Countries in italics rank at least ten places lower on levels of verified emissions than they do on meeting their EU ETS targets.

governments, Portugal and Sweden. However, Greece is not meeting targets and has only a slightly less leaning cabinet than Sweden. Greece has a cabinet ideology score of 5.99 while Sweden's is a 5.71.

Past Environmental Records. There has been a distinction made between leaders and laggards in environmental policy and protection in European countries. In particular, Denmark, Germany, Austria, Sweden, Finland and the Netherlands all have records as leaders in environmental policy while Portugal, Greece, Italy, Spain, Ireland, and Belgium all have reputations as environmental laggards (Anderson and Liefferink 1998; Barnes and Barnes 1999). The case studies specifically examine two traditional leader states, Sweden and Denmark, and two traditional laggard states, Portugal and Greece. As Table 5.1 indicates, the traditional reputations for being an environmental leader or laggard do not seem to correspond to being a leader or laggard state in regard to emissions reductions. Based on their previous reputations, one might assume that Sweden and Denmark would be more effective at reducing their emissions than Portugal and Greece. However, the performance of these countries in regard to emissions reduction is not so simple. Sweden is doing well in reducing its overall emissions from EU ETS facilities, ranking third out of all EU member states and meeting its targets, while Denmark has been struggling to reduce its CO_2 emissions. When examining emissions reduction performance of the traditional laggards, Portugal has been successful in reducing their overall verified emissions from EU ETS facilities, while Greece has had little success, frequently missing its targets and has the 23rd worst record in overall verified emissions rates.

The reputations of environmental leaders and laggards may be changing as the types of environmental issues that countries are facing change. State capacity and effectiveness of environmental institutions are directly related to a state's ability to enforce environmental law.

"Greece, Spain and Portugal have often lacked the capacity (resources) rather than the willingness to effectively implement EU policies" (Koutalakis and Font 2006, 6). Differences in the severity and type of other environmental problems in a country besides climate change may have shaped the countries' institutions, leaving some states better or worse equipped to deal with a transboundary problem like climate change. Some countries, like Portugal and Greece, did not have institutional experience with environmental protection until they joined the EU and were able to create institutions when they were aware of the types of environmental law they would be expected to enforce as member states. Table 10.3 compares the cases across several variables, including dates when environmental ministries were first introduced and/or restructured, as well as across several factors relating to their performance in reducing carbon emissions.

Table 10.3: Environmental Institutions and Emissions Performance across Cases

	Sweden	Denmark	Portugal	Greece
Leader/Laggard	Leader	Leader	Laggard	Laggard
Institutionalization	1967 Swedish Environmental Protection Agency, 1987 Environment and Energy Ministry	1971 Ministry for Pollution Control,1973 Ministry of Environment	1990 Ministry of Environment and Natural Resources	1980 Ministry of Planning, Housing and Environmental Services; 1985 Ministry of Environment, Spatial Planning and Public Works; 2009 Ministry of Environment, Energy, and Climate Change
Past Infringement	55	47	185	157
Emissions per capita	2.16	5.10	2.88	6.07
Adaptation Plan	Yes	Yes	Yes	No
Allocation Plan Accepted	Yes	Yes	Yes	Yes
Meeting targets	Yes	No	Yes	No

Greece has several contextual factors that all tie in to its poor performance in reducing emissions. It has not been meeting its EU ETS targets in most years; it has not yet adopted an adaptation plan, it has the highest per-capita CO_2 emissions (in tonnes) of any other case examined, and it had a relatively late establishment of an environmental ministry, which also had a reputation for being weak and lacking capacity (Getimis, Giannakourou, and Dimadma 2003). Denmark also has high rates of per-capita CO_2 emissions relative to the two leaders, Sweden and Portugal. A record of past infringement does seem to follow the patterns of traditional leaders and laggards, with Denmark and Sweden out-performing Portugal and Greece in terms of the number of formal infringement actions taken against them.

Energy. The amount of renewable energy being produced in the country is both significant for reducing verified emissions in the statistical models and appears to be significant in the cases, with Sweden and Portugal producing more per person than Denmark and Greece. However, in terms of meeting EU emissions targets, the statistical models suggest that countries producing more renewable energy would be less likely to meet emissions targets, and the cases reflect the opposite, with Denmark and Greece producing the least renewable energy and missing their targets, while Sweden and Portugal produce the most energy from renewables and meet their targets. Given this, it is also important to note that all of the countries produce some renewable energy from multiple sources (see Table 10.4). In addition, all countries have potential for expanded production across multiple sources of renewable energy.

Oil Production does not seem to play a major role in the cases, though Denmark and Greece are the two largest producers of oil, and are the two states failing to meet their targets and effectively reduce their emissions. However, Denmark is a clear outlier as one of the largest producers of oil per capita in all of Europe. By comparison, oil production in the other cases

Table 10.4: Renewable Energy Production by Source, 2010

	Sweden	Denmark	Portugal	Greece	EU 27
Renewables Per Capita	76.745	10.144	14.491	6.165	19.13
Biomass Thousand toe	11387	2424	2994	887	112725
Geothermal Thousand toe	0	10	190	27	5881
Hydro power Thousand toe	5709	2	1388	641	31492
Solar Thousand toe	11	16	76	197	3686
Wind Thousand toe	301	671	790	233	12817
Energy Intensity Kg of oil equivalent per 1,000 EUR of GDP	156.67	104.05	179.66	165.47	167.99
Electricity Generated from Renewables % of gross electricity consumption	56.37	27.39	33.27	12.27	18.21
Environmental Expenditure – Public Sector % of GDP	.35	.66	.67	.76	.69
Environmental Expenditure – Industry % of GDP	.32	.43	.27	.36	.43

Source: Eurostat. Available at:
http://epp.eurostat.ec.europa.eu/guip/mapAction.do?indicator=ten00082_2&mapMode=dynamic&mapTab=1

seems incredibly negligible (see Table 10.1). Even so, Denmark is moving towards a goal of all domestic energy production coming from renewable sources by 2050[76]. Future research will allow examination of how planned policy shifts like these affect countries' energy portfolios, and if they result in desired emissions reductions.

Public Opinion on Climate Change. The impact of national public opinion on climate change does not seem to have clear effects. See Table 10.5 for a comparison of responses to questions in Special Eurobarometer 322 on climate change. In Sweden, the level of concern about climate change is high, and Swedes think the issue is very serious, but so do Greeks and they have opposite records of emissions performance.

[76] See http://www.ens.dk/en-US/policy/danish-climate-and-energy-policy/danishclimatecommission/Sider/Forside.aspx

Table 10.5: Public Opinion on Climate Change

	Sweden	Denmark	Portugal	Greece	EU 27
Most Serious Problem	75% (highest of all EU)	69%	28% (lowest of all EU)	71% (Second highest in EU)	47%
Very Serious Problem	68%	63%	53%	84% (highest)	63%
EU Not Doing Enough	68%	52%	53%	67%	55%
EU Doing Right Amount	24%	40%	22%	29%	30%
National Gov Not Doing Enough	59%	48%	59%	84% (highest)	62%
National Gov Doing the Right Amount	34%	46%	20%	13%	27%
Corporations and Industry Not Doing Enough	70%	61%	64%	94% (highest)	72%
Corporations and Industry Doing Right Amount	24%	34% (highest)	15%	4% (lowest)	19%
Climate Change is Unstoppable	26%	28%	29%	18%	31%
Climate Change is Not Unstoppable	72%	69%	66%	81%	62%
Environmental Protection can Boost Growth	75%	75%	62%	80%	66%
Environmental Protection cannot Boost Growth	14%	15%	9%	11%	18%
Environmental Protection is an Obstacle to Growth	24%	33%	32%	28%	26%
Environmental Protection is not an Obstacle to Growth	69%	63%	41%	65%	60%

Portuguese are the least likely citizens in any of the cases examined to think that climate change is one of the most serious issues facing the world, but their emissions reduction record has been very good. In addition, Public Opinion did not yield a clear or significant effect in any of the statistical models. This lack of effect is possibly due to the relatively high levels of concern about climate change across Europe. Concern about climate change is already widespread enough in the EU that its influence was seen in the existence of enough political will to establish the EU ETS in the first place. The actual results of the policy in terms of reduction state by state seem to be driven more by factors other than the concerns of the public.

Emissions Performance. Sweden and Portugal have the best records out of the cases in meeting their ETS targets, meeting their targets every year between 2005 and 2010, and having the lowest levels of per-capita emissions from ETS facilities (see Figure 10.1).

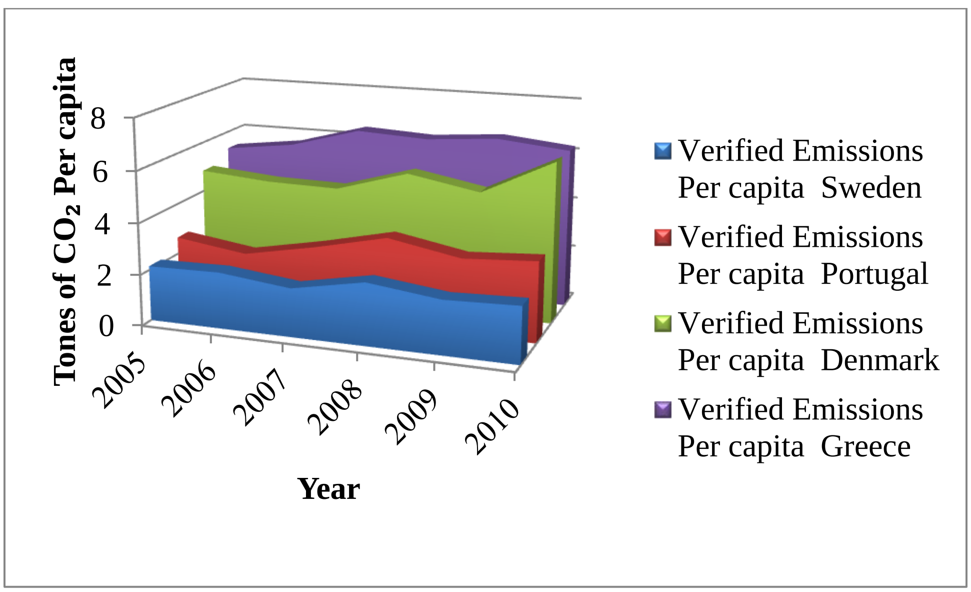

Figure 10.1: Emissions Performance of Case Study Member States: Verified Emissions Per Capita from ETS Facilities

Sweden and Portugal also outperform Denmark and Greece in total emissions of CO_2 (including all CO_2 emissions, not just those from facilities under the ETS). Sweden and Portugal

are also doing well when compared to the average for all member states, while Denmark and Greece are doing poorly (see Figure 10.2).

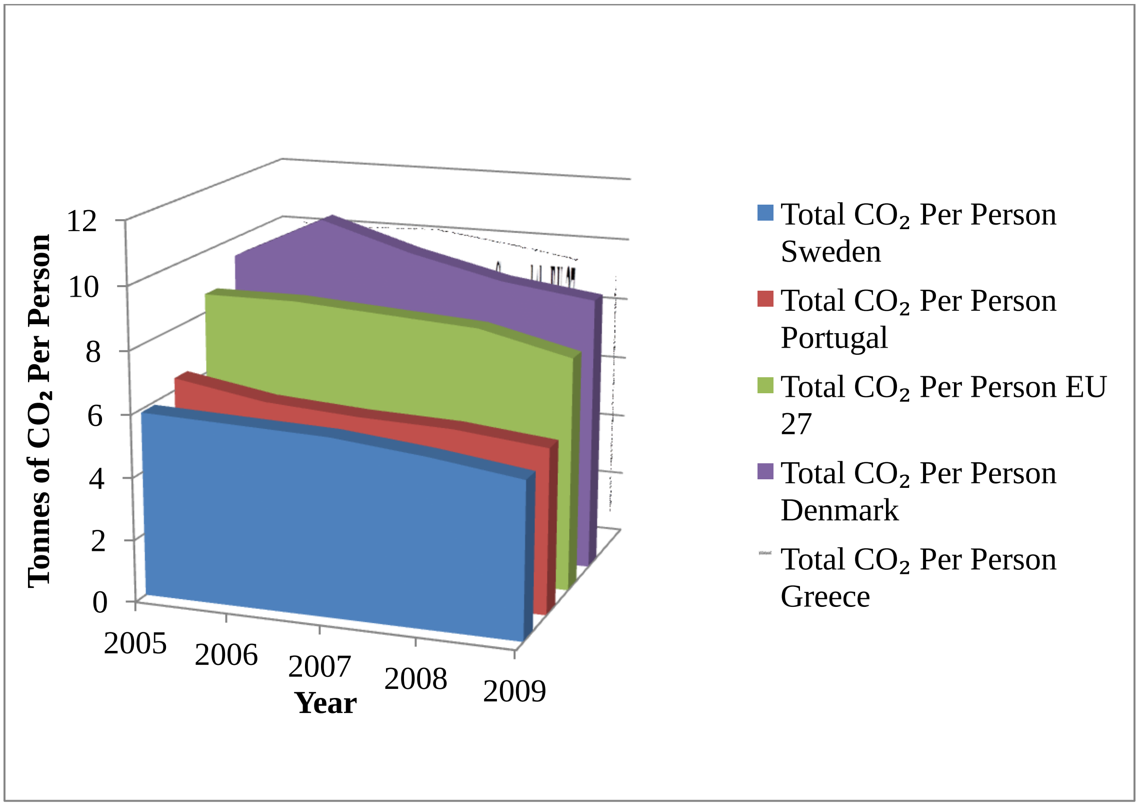

Figure 10.2: Total CO_2 Emission Per Capita across Cases and the EU 27

Conclusions and Future Research

A country's efficacy at reducing their emissions seems to be driven by factors that are different from what seems to predict their ability to meet emissions targets. Being highly corrupt, producing more renewable energy, and having been in the EU longer, seems to indicate success in reducing emissions, according to the models in Chapter 4. However, low levels of corruption, producing less renewable energy, and having been in the EU less time, seems to indicate an increased likelihood of meeting emissions targets. In terms of actual, substantive outcomes, it seems that explaining the reduction of emissions, rather than explaining meeting targets seems

potentially more important for providing lessons that can enhance future policy. The desired goal is to reduce emissions, and ideally, reduce emissions in all countries. However, the setting of emissions targets is clearly influenced by domestic and EU level politics, and this context is important. Desires for fairness and burden-sharing across the EU member states in meeting Kyoto targets is part of a political reality that is unlikely to go away anytime soon. There are large discrepancies in terms of institutional capacity, wealth, and other resources that would make it seemingly too difficult to push a single common standard to be applied in each member state. Additionally, by setting targets, the EU may be more effectively maximizing emissions reduction by putting more pressure on states with better capacity to reduce their own emissions. Future research is needed to better disentangle the different influences that improve emissions reduction, versus the factors that improve the ability to meet targets.

Overall, energy policy does have direct implications for total emissions in a country and therefore energy policy and climate policy are two arenas that continue to be closely tied to each other. Having a commitment to producing renewable energy does seem to be connected to better performance in lowering emissions. There is evidence indicative of this relationship in both the quantitative analysis and the qualitative case studies. Since the time period examined in this study includes the trial phase and the first phase of compliance, patterns of influencing variables may change the longer the EU ETS remains in place. States that have trouble meeting their targets for the first compliance phase of Kyoto (which also overlaps with the second phase of the ETS) may be under more pressure than other states to start meeting their targets. Future research is needed to examine the performance of EU member states in reducing their ETS facility emissions over a longer period of time, and eventually, evaluate if there were any major

differences between the initial trial phase, and the subsequent phases where Kyoto compliance becomes a more influential factor.

References

Allen, Mahalley D., Carrie Pettus and Donald P. Hader-Markel. 2004. “Making the National Local: Specifying the Conditions for National Government Influence on State Policymaking,” *State Politics and Policy Quarterly* 4: 318-344.

Anderson, Michael Skou and Duncan Liefferink (eds). 1997 *European Environmental Policy: The Pioneers.* New York: Manchester University Press.

Bailey, Michael A., and Mark Carl Rom. 2004. “A Wider Race? Interstate Competition Across Health and Welfare Programs,” *Journal of Politics* 66: 326-47.

Barbier, E.B., Damania, R., and Leonard, D. 2005. “Corruption, Trade, and Resource Conversion.” *Journal of Environmental Economics and Management.* 50: 276-299.

Baron, R. and C Philibert 2005. *Act Locally, Trade Globally: Emissions Trading for Climate Policy*. Paris: OECD.

Berry, Francis S. and William D. Berry. 1990 “State Lottery Adoptions as Policy Innovation: An Event History Analysis.” *American Political Science Review* 84(2): 395-415.

Berry, William, and Brady Baybeck. 2005. “Using Geographic Information Systems to Study Interstate Competition.” *American Political Science Review* 99: 505-19.

Blocker, T. Jean and Douglas Lee Eckberg. 1989. “Environmental Issues as Women’s Issues: General Concerns and Local Hazards.” *Social Science Quarterly* 70: 586-93.

Bord, Richard J. and James O’Connor. 1997. “The Gender Gap in Environmental Attitudes: The Case of Perceived Vulnerability to Risk.” *Social Science Quarterly* 78: 830-40.

Borick, Christopher P. and Barry G. Rabe. 2009. “A Reason to Believe: Examining the Factors that Determine Individual Views on Global Warming,” Paper presented at the Annual Meeting of the Western Political Science Meeting, March 19-21, Vancouver, British Columbia.

Borzel, Tanja A. 2000. “Why there is no ‘southern problem’. On Environmental leaders and laggards in the European Union. *Journal of European Public Policy* 7(1):141-162.

Bruneau, Thomas C. and Alex Mcleod. 1986. *Politics in Contemporary Portugal.* Boulder: Lynne Reinner.

Camyar, Isa. 2007. Casting Light into “The Black Hole”: Partisan Politics of European Compliance.” Ph.D. diss. Louisiana State University.

Cappelletti, Mauro, Monica Seccombe and Joseph Weiler. 1986. *Integration through Law: Europe and the American Federal Experience.* New York: W. de. Gruyter.

Carruba, Clifford J. 2001. “The Electoral Connection in European Politics” *The Journal of Politics.* 63(1) 141-158.

Casimiro, Elsa, Jose Calheiros, Filipe Duarte Santos, and Sari Kovats. 2006. “National Assessment of Human Health Effects of Climate Change in Portugal: Approach and Key Findings.” *Environmental Health Perspectives.* 14(12):1950-1956.

Claussen, Eileen. 2004. “An Effective Approach to Climate Change,” *Science* 306: 81

Dessai, S., 2003. Heat stress and mortality in Lisbon Part II. An assessment of the potential impacts of climate change. International Journal of Biometeorology 48(1): 37-44.

Dehouse, Renaud. 1992. “Integration v. Regulation? On the Dynamics of Regulation in the European Community” *Journal of Common Market Studies* 30(4): 392.

Dunlap, Riley E. 2008. “The New Environmental Paradigm Scale: From Marginality to Worldwide Use.” *Journal of Environmental Education.* 40(1) 3-18.

Dunlap, Riley E. and Angela G. Mertig. 1992. *American Environmentalism: The U.S. Environmental Movement, 1970-1990.* New York: Taylor & Francis

Dunlap, Riley E. and Aaron M. McCright. 2008a. “Social Movement Identity: Validating a Measure of Identification with the Environmental Movement.” *Social Science Quarterly* 89(5): 1045-1065.

Dunlap, Riley E. and Aaron M . McCright. 2008b. “A Widening Gap: Republican and Democratic Views on Climate Change.” *Environment* 50(5): 26-35.

Duverger, Maurice. 1980. “A New Political System Model: Semi-presidential Government.” *European Journal of Political Research* 8:165-87.

Elder, Jon, Alastair H. Tomas, and David Arter. 1998. *The Consensual Democracies? The Government and Politics of the Scandinavian States,* rev. ed. Oxford: Basil Blackwell.

EEA. 2008a. “Heat and health (CLIM 036) – Assessment” http://www.eea.europa.eu/data-and-maps/indicators/heat-and-health/heat-and-health-assessment-published

EEA. 2009a. “Europe’s Onshore and Offshore Wind Energy Potential: An Assessment of Environmental and Economic Constraints.” EEA Technical report No 6/2009. http://www.eea.europa.eu/publications/europes-onshore-and-offshore-wind-energy-potential

EEA. 2009b. “Water Resources Across Europe – Confronting Water Scarcity and Drought.” EEA report No 2/2009

EEA. 2008b. “Impacts of Europe’s Changing Climate – 2008 Indicator-based Assessment” EEA Report NO 4/20

Ellerman, A. Denny, and Paul L. Joskow. 2008. “The European Union’s Emissions Trading System in Perspective”. Pew Center on Global Climate Change. (available at http://www.pewclimate.org/eu-ets)

Ellerman, A. Denny, Barbara K. Buchner, and Carlo Carro. 2007. *Allocation in the European Union Emissions Trading Scheme: Rights, Rents, and Fairness.* Cambridge: Cambridge University Press.

Erickson, Robert S., Gerald Wright, and John P. McIver. 1993. *Statehouse Democracy: Public Opinion and Policy in the American States*, New York: Cambridge University Press.

“Emissions Trading Scheme (EU ETS)” European Commission. 12/7/2008. http://ec.europa.eu/environment/climat/emission/citl_en.htm

Eurobarometer. 2008. “Europeans Attitudes on Climate Change” Special Eurobarometer 300

Eurobarometer. 2009. “Europeans Attitudes on Climate Change” Special Eurobarometer 322

European Commission. 2007/589/EC: Commission Decision of 18 July 2007 establishing guidelines for the monitoring and reporting of greenhouse gas emissions pursuant to Directive 2003/87/EC of the European Parliament and of the Council (notified under document number C(2007) 3416)

European Commission. 2004a. Commission decision for the monitoring and reporting of greenhouse gas emissions pursuant to Directive 2003/87/EC of the European Parliament and of the Council, 2004/156/EC dated 29 January 2004.

European Commission. 2004b. Commission regulation for a standardised and secured system of registries pursuant to Directive 2003/87/EC of the European Parliament and of the Council and Decision No 280/2004/EC of the European Parliament and of the Council, 2216/2004/EC dated 21 December 2004.

European Commission. *Environment Fact Sheet: Climate Change.* 2005. KH-15-04-002-EN-C.

European Commission. 2006. *The European Climate Change Program*. http://ec.europa.eu/environment/climat/pdf/eu_climate_change_progr.pdf

European Commission. 2000. Green Paper on greenhouse gas emissions trading within the European Union, COM(2000)87, 3 March.

European Commission. 2006. Questions and Answers on Emissions Trading and National Allocation Plans for 2008 to 2012. MEMO/06/452 (available at http://ec.europa.eu/environment/climat/pdf/m06_452_en.pdf)

European Environment Agency. 2008. Greenhouse gas emission trends and projections in Europe 2008: Tracking progress toward Kyoto targets, EEA Report No. 5/2008 (available at: http://reports.eea.europa.eu/eea_report_2008_5/en)

Font, Nuria and Francesc Morata. 1992. "Environmental Policy in Spain" in *Environmental Administration and Policymaking*, ed A.I. Jansen and K. Hanf. London: Harvester and Wheatsheaf.

Fredriksson, Per G. and Svensson, J. 2003. "Political Instability, Corruption and Policy Formation: The Case of Environmental Policy. *Journal of Public Economics.* 87: 1383-1405

Fredriksson, Per G. and Jim Wollscheid. 2010. "Party Discipline and Environmental Policy: The Role of "Smoke-filled Back Rooms". *The Scandinavian Journal of Economics.* 112(3): 489-513.

George, Alexander, L. and Andrew Bennett. 2005. *Case Studies and Theory Development in the Social Sciences.* Cambridge: MIT Press.

Getimis, Panagiotis, Georgia Giannakourou and Zafeiroula Dimadama. 2003. "EMAS in Greece." In *Sustainability, Innovation and Participatory Governance: A Cross-National Study of the EU Eco-Management and Audit Scheme,* ed. Heinelt, Hubert and Randall Smith. Burlington: Ashgate Publishing Company, 151-164.

Gray, Virginia. 1973. "Innovations in the States: A Diffusion Study." *American Political Science Review* 67: 1174-91

--------. 1994. "Competition, Emulation, and Policy Innovation." *In New Perspectives on American Politics*, ed. Lawrence C. Dodd and L.C. Calvin Jillson. Washington, DC: Congressional Quarterly Press.

Gray, Virginia, and Russell Hanson. 2008. *Politics in the American States: A Comparative Analysis* (9th edition), Washington, DC: Congressional Quarterly Press.

Greenberg, Michael R. 2004. "Is Public Support for Environmental Protection Decreasing? An Analysis of U.S. and New Jersey Data." *Environmental Health Perspectives* 112(2): 121-125.

Guber, Deborah Lynn. 2003. *The Grassroots of a Green Revolution: Polling America on the Environment.* Boston: MIT Press.

Harrison, Kathryn and Lisa McIntosh Sundstrom. 2007. "The Comparative Politics of Climate Change." *Global Environmental Politics* 7(4): 1-18.

Haigh, N. 1999. "European Union environmental policy at 25: retrospect and prospect" *Environment and Planning C: Government and Policy*. 17: 109-112

Hardin, Garret. 1962. "The Tragedy of the Commons" *Science.* 16: 1243-1248

Holdren, John P. and Paul R. Ehrlich. 1971. "Impact of Population Growth" *Science*. 171: 1212-1217.

--- 1974. "Human Population and the Global Environment." *American Scientist* 62: 282-292.

Howard, Marc M. 2003. *The Weakness of Civil Society in Post-Communist Europe*. New York: Cambridge University Press.

Ingle, William Kyle, Lora Cohen-Vogel, and Roxanne Hughes. 2007. "The Public Policy Process among Southeastern States: Elaborating Theories of Regional Adoption and Hold-Out Behavior." *Policy Studies Journal* 35(4): 607-628.

Inglehart, Ronald.1997. *Modernization and Postmodernization: Cultural, Economic, and Political Change in 43 Societies.* Princeton: Princeton University Press

IPCC. 1990. Overview: First Assessment Report on Climate Change. Accessed at http://www.ipcc.ch/ipccreports/1992%20IPCC%20Supplement/IPCC_1990_and_1992_Assessments/English/ipcc_90_92_assessments_far_overview.pdf

IPCC, 2007: Summary for Policymakers. In: *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M.Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

Jänicke, Martin. 2002. "The Political System's Capacity for Environmental Policy: The Framework for Comparison." In *Capacity Building in National Environmental Policy: A Comparative Study of 17 Countries.* New York, NY: Springer-Verlag

Jensen, Christian B. and Jae-Jae Spoon. 2011. "Testing the 'Party Matters' Thesis: Explaining Progress towards Kyoto Protocol Targets" *Political Studies* 59:99-115.

Jordan, A. 1999. "The implementation of EU environmental policy: a policy problem without a political solution?" *Environment and Planning C: Government and Policy.* 17: 69-90.

Johnson, Martin, Paul Brace, and Kevin Arceneaux. 2005. "Public Opinion and Dynamic Representation in the American States: The Case of Environmental Attitudes." *Social Science Quarterly* 86(1): 87-108.

Keleman, R. Daniel. 2000. "Regulatory Federalism: EU Environmental Regulation in Comparative Perspective. *Journal of Public Policy* 20(3): 133-167.

Kerr, Richard A. 2001. "Major Challenges for Bush's Climate Initiative," *Science* 293: 199-201

Kerr, Richard A. 2007. "U.S. Policy: A Permanent Sea Change?" *Science* 315: 756-757.

Kraft, Michael E. and Denise Scheberle. 1998. "Environmental Federalism at Decade's End: New Approaches and Strategies," *Publius* 28: 131-146

Kline, Benjamin. 2011. *First Along the River: A Brief History of the U.S. Environmental Movemet.* New York: Rowman & Littlefield

Klineberg, Stephen, Matthew McKeever, and Bert Rothenbach. 1998. "Demographic Predictors of Environmental Concern: It Does Make a Difference How It's Measured." *Social Science Quarterly* 79(4): 734-53.

Konisky, David M. 2007. "Regulatory Competition and Environmental Enforcement: Is There a Race to the Bottom? *American Journal of Political Science* 51: 853-872.

Konisky, David M., Jeffrey Milyo, and Lilliard E. Richardson. 2008. "Environmental Policy Attitudes: Issues, Geographical Scale, and Political Trust." *Social Science Quarterly* 89(5): 1066-1085.

Koutalakis, Charalampos and Nuria Font. 2006. "Coping with accession. The application of new modes of governance in the adoption of and adaptation to EU environmental policies in Greece, Spain and Portugal." Paper prepared for the ECPR Standing Group on EU Politics Third Pan-European Conference Bilgi University, Istanbul, 21-23.

Krislov, S, Ehlermann C, Weiler J. 1986. "The political organs and the decision-making process in the U.S. and the EC", in *Integration Through Law, V. 1, Book 2*. deGruyter: The Hague.

Laughlin, Tom. 2005. "Evaluating New Federalism Arguments in the Area of the Environment: The Search for Empirical Measures." *New York University Environmental Law Journal*13: 481-500.

Lijphart, Arend. 1999. *Patterns of Democracy: Government Forms and Performance in Thirty-Six Countries.* New Haven: Yale University Press.

Lindamen and Haider-Markel. 2002. “Issue Evolution, Political Parties, and the Culture Wars.” *Political Research Quarterly*. 55(1): 91-110.

Lopez, Ramon and Siddartha Mitra. 2000. “Corruption, Pollution and the Kuznets Environment Curve. *Journal of Environmental Economics and Management.* 40(2):137-150.

Lupia and McCubbins 1998. *The Democratic Dilemma.* Cambridge: Cambridge University Press.

Majone, Giandomenico. 1993. “The European Community Between Social Policy and Social Regulation” *Journal of Common Market Studies* 31(2).

Mazurski KR. 1991. “Communism and the Environment.” *Forum for Applied Research and Public Policy.* 5(4): 39-44.

Mohai, Paul and Bunyan Bryant. 1998. “Is There a ‘Race’ Effect on Concern for Environmental Quality?” *Public Opinion Quarterly* 62: 475-505.

Montgomery, W.D. 1972. “Markets in licenses and efficient pollution control programs” *Journal of Economic Theory* 5(3): 395-418

Mooney, Christopher Z. and Mei-Hsien Lee. 1999. “The Temportal Diffusion of Morality Policy: The Case of the Death Penalty Legislation in the American States.” *Policy Studies Journal* 27(4): 766-780.

Montgomery, W.D. 1972. “Markets in licenses and efficient pollution control programs” *Journal of Economic Theory* 5(3): 395-418

Muir, John. 1901. *Our National Parks.* New York: Houghton Mifflin

Muir, John. 1912. *The Yosemite.* New York: The Century Company.

Nash, Roderick. 1967. “John Muir, William Kent, and the Conservation Schism.” *Pacific Historical Review* 35:4: 423-433.

National Academy of Sciences. Committee on Science, Engineering, and Public Policy. 1991. “NES on Policy Implications of Greenhouse Warming,” *Population and Development Review* 17: 364-367.

Nistor, Laura. 2010. “The Role of the Internet in Shaping Environmental Concern. A Focus on Post-Communist Europe.” *Journal of Comparative Research in Anthropology and Sociology*. 1(2): 145-167.

Nogueira Acala, Humberto. 1986. *El regimen semipresidential: Una nueva forma de gobierno democrático?* Santiago: Editorial Andante.

Opello, Walter C. 1985. *Portugal's Political Development*. Bolder: West View Press.

O'Riordan, Tim and Jill Jäger, Eds. 1996. *Politics of Climate Change: A European Perspective.* London: Routledge.

Ostrom, Elinor.1990. *Governing the Commons* New York: Cambridge University Press.

Pellegrini, Lorenzo and Reyer Gerlagh. 2006a. "Corruption, Democracy, and Environmental Policy: An Emperical Contribution to the Debate." *The Journal of Environment and Development* 15:332-354.

Pellegrini, Lorenzo and Reyer Gerlagh. 2006b. "Corruption and Environmental Polices: What are the Implicaitons for the Enlarged EU?" *European Environment.* 16:139-154.

Pew Center on Global Climate Change. 2005. "The European Union Emissions Trading Scheme (EU-ETS) Insights and Opportunities" (available at http://www.pewclimate.org/docUploads/EU-ETS%20White%20Paper.pdf)

Pew Research Center for the People and the Press. 2008. "A Deeper Partisan Divide over Global Warming" (available at: http://www.people-press.org/files/legacy-pdf/417.pdf)

Pigou, Arthur C. 1920. *The Economics of Welfare.* London: Macmillan and Company.

Pinchot, Gifford. 1937. "How Conservation Began in the United States." *Agricultural History* 11(4):255-265

Pinchot, Gifford. 1947. *Breaking New Ground.* New York: Harcourt Brace.

Popkin, Samuel L. 1991. *The Reasoning Voter: Communication and Persuasion in Presidential Campaigns.* Chicago: University of Chicago Press.

Pridham, Geoffery, Suzannah Verney and Dimitri Konstadakopulos. 1995. "Environmental policy in Greece: evolution, structures and process," *Environmental Politics* 4(2): 244-270.

Rabe, Barry. 2002. "Greenhouse and Statehouse: The Evolving State Government Role in Climate Change." *Pew Center on Global Climate Solution.s.* Accessed at http://www.pewclimate.org/docUploads/states_greenhouse.pdf

Raloff, J. 1993. “Clinton Unveils New ‘Greenhouse’ Policy,” *Science News* 144: 263

Revesz, Richard L. and Robert N. Stavins. 2004. “Environmental Law and Public Policy”. Resources for the Future Discussion Paper 04-30 REV.

Ringquist, Evan. 1993a. “Does Regulation Matter?: Evaluating the Effects of State Air Population Control Programs,” *Journal of Politics* 55: 1022-1045.

Ringquist, Evan. 1993b. *Environmental Protection at the State Level: Politics and Progress in Controlling Pollution.* Armonk, NY: M.E. Sharpe.

Sbragia, Alberta, ed. 1992a. *Euro-politics: Institutions and Policymaking in the ``New'' European Community.* Washington, DC: Brookings.

Sbragia, Alberta. 1992b. “Environmental Policy in the European Community: The Problem of Implementation in Comparative Perspective”. In *Towards a Transatlantic Environmental Policy.* Washington DC: the European Institute.

Sbragia Alberta, 1999. "From laggard to leader: the EU institution building and the politics of climatic change" *Environment and Planning C: Government and Policy* 17: 53 – 68

Scharpf, Fritz W. 1988. “The Joint Decision Trap: Lessons from German Federalism and European Integration”. *Public Administration* 66.

Schultz, P. Wesley. “Empathizing with Nature: The Effects of Perspective Taking on Concern for Environmental Issues.” *Journal of Social Issues* 56(3): 391-406.

Scrieciu and Stringer. 2008. “The Transformation of Post-Communist Societies in Central and Eastern Europe and the Former Soviet Union: and Economic and Ecological Sustainability Perspective.” *European Environment.* 18: 168-185.

Shipan, Charles R., and Craig Volden. 2006. “Bottom-Up Federalism: The Diffusion of Antismoking Policies from U.S. Cities to States,” *American Journal of Political Science* 50: 825-43

Shugart, Matthew Soberg, and John M. Carey. 1992. *Presidents and Assemblies: Constitutional Design and Electoral Dynamics.* New York: Cambridge University Press.

Stimson, James A. 1991. *Public Opinion Moods, Cycles, & Swings.* Oxford: Westview Press.

Thompson, S.G. and Barton, M.A. 1994. “Ecocentric and Anthropocentric Attitudes About the Environment.” *Journal of Environmental Psychology* 14: 149-157.

Tietenberg, T.H. 1985. *Emissions Trading: An Excuse in Reforming Pollution Policy.* Washington DC: Resources for the Future.

Tranter and Western. 2009. "The Influence of Green Parties on Postmaterialst Values." *The British Journal of Sociology.* 60: 145-167.

Turner, Robert C. and Mark K. Cassell. 2007. "When Do States Pursue Targeted Economic Development Policies? The Adoption and Expansion of State Enterprise Zone Programs." *Social Science Quarterly* 88(1): 86-103

Van Liere, Kent, and Riley Dunlap. 1981. "Environmental Concern: Does It Make a Difference How It's Measured?" *Environment and Behavior* 13(6): 651-84.

Voβ, Jan-Peter. 2007. "Innovation processes in governance: the development of 'emissions trading' as a new policy instrument

Vogel, David. 1995. *Trading Up: Consumer and Environmental Regulation in a Global Economy*. Cambridge, MA: Harvard University Press.

Volden, Craig. 2006. "States as Policy Laboratories: Emulating Success in the Children's Health Insurance Program," *American Journal of Political Science* 50: 294-312

Weidner, Helmut. 2002. *Capacity Building in National Environmental Policy: A Comparative Study of 17 Countries.* New York, NY: Springer-Verlag.

Williams, Bruce A. 1999. "Economic Regulation and Environmental Protection," in *Politics in the American States,* 7th edition, eds. Gray and Hanson, Washington, D.C.: Congressional Quarterly Press.

Wilson, John K. and Richard Damania. 2005. "Corruption, Political Competition and Environmental Policy." *Journal of Environmental Economics and Management.* 49: 516-535.

Woods, Neal D. 2006. "Interstate Competition and Environmental Regulation: A Test of the Race to the Bottom Thesis," *Social Science Quarterly* 86: 792-811.

Woods, Neal D. 2008. "The Policy Consequences of Political Corruption: Evidence from State Environmental Programs." *Social Science Quarterly* 89: 258-271.

Wright, D. Brad. 2004. "Universal Access to Healthcare: Lessons from Sweden for the United States" Accessed at: http://www.unc.edu/~wedavid/web/Comparative%20HC%20Systems%20Paper.pdf

Wright, Gerald C., Robert S. Erikson, and John P. McIver. 1987. "Public Opinion and Policy Liberalism in the American States," *American Journal of Political Science* 31: 980-1001.

Wurzel, Rüdiger K.W. 2006. *Environmental Policy-Making in Britain, Germany, and the European Union: the Europeanization of Air and Water Pollution Control.* Manchester: Manchester University Press.

Zaller, John R. 1992. *The Nature and Origins of Mass Opinion.* Cambridge: Cambridge University Pres.

Vita

Tabitha Cale was born in Clearwater, Florida. She earned her bachelor's degree in political science from the University of Florida in 2005, and her master's degree from Louisiana State University in 2010. Her dissertation, entitled "Climate Change Policy in the European Union: Examining the Emissions Trading Program" represents her combination of interests in the environment, stemming from a life-long appreciation for natural history, and politics.