Climate policies – (the feasibility of) a statistical analysis of their determinants

Nana Künkel, Klaus Jacob, Per-Olof Busch

Abstract: Countries vary considerably in the stringency and type of their domestic climate policies as well as regarding their international commitments. What are the explanatory factors for this variance? In our paper we firstly analyze in how far countries are comparable regarding their degree of ambition in climate policies despite of different preferences as regards policy instruments. Secondly, we relate the policy outputs of Annex 1 countries to a model of environmental policy capacities. We first develop a measure of climate policy performance to capture the various aspects of climate policy. Our index draws together existing quantitative and qualitative information on national climate policies by sector for three time periods. We discuss the overall ranking of countries, their position by sector, and changes in position over time. We then aim to explain the relative position of a country in terms of its capacity. Our model of capacities for environmental policies encompasses the relative strength, competence and configuration of the governmental and non-governmental proponents of environmental protection and the specific cognitive-informational, political-institutional and economic-technological framework conditions. Emphasis is put on issue specific capacities, e.g. the share of CO_2 intensive industries in GDP. The aggregate performance measures for different periods are correlated with components of climate policy capacities. With our model of capacities we offer an explanation for the relative position of the degree of a country's ambition and we also analyze in how far different elements of political capacity are decisive for the policy profile.

Introduction

When the government of the United Kingdom published its policy strategy to tackle climate change in March 2006, the so called *UK Climate Change Programme*, it claimed self-confident that the "UK is already at the forefront of fight against climate change" (UK Government 2006:3) and promised to "continue to play a leadership role in 2006 and beyond" (UK Government 2006:3; see also DEFRA 2006:24). Likewise, the German government, notably its environment ministers, attributes itself a "leading role in climate protection" (BMU 2006a:5; see also BMU 2006b) and sees itself as "pioneer in international climate politics" (BMU 2003). Even U.S. President George W. Bush who is blamed for the withdrawal of the United States of America from the Kyoto Protocol states that the U.S. administration "is committed to a leadership role on the issue of climate change" (cited in U.S. Department of State 2002:2), domestically and internationally. This list could be easily extended to other developed countries, such as Australia, Canada, Japan, the Netherlands, or New Zealand.

While the self-descriptions through governments could be dismissed as self-marketing, the attribution of such labels is also widespread in political science contributions that analyze and evaluate international and domestic climate policies. In particular, the European Union (EU), Germany, the Netherlands, and Norway feature prominently as pioneers or leaders in international and domestic climate policies (e.g. Andersson and Mol 2002; Andresen and Agrawala 2002; Gupta 1998; Gupta and Ringius 2001; Huber 1997; Jaeger et al. 1997). China, too, is cited among those countries "with the most ambitious policies that will reduce greenhouse gas emissions" (Stern forthcoming 2007:viii, see also xxiv), although it is not committed to a legally binding greenhouse gas reduction target under the Kyoto Protocol to the United Nations Framework Convention of Climate Change (UNFCCC). Interestingly, some of these studies indicate that these pioneering or leading roles may be lost over time (e.g. Andresen and Butenschon 2001; Christiansen and Wettestad 2003; Gupta and Grubb 2000; Kennaway 1999; Michaelowa 2003; Samson 2001; Sæverud and Wettestad 2006; Sbragia and Damro 1999). Statistical measurements of climate policy performance under-score these largely qualitative assessments and likewise reveal a variation across nations (e.g. Esty et al. 2006). Moreover, a comparison of the 2005 and 2006 climate change performance indexes of Germanwatch (2005; 2006) confirms the finding that the performance of countries varies over time. For example, from 2005 to 2006 Portugal fell from rank 19 to 25, the Netherlands even lost fourteen ranks (from 15 to 29). Inversely, Sweden climbed from the seventh rank in 2005 to the first in 2006, Denmark from the fourteenth to the third.

This paper starts from these observations that the ambition and stringency of domestic and international climate policies varies across governments and over time. However, we attempt to advance the hitherto research methodologically and analytically. Our main purpose is twofold. On the one hand we seek to base the identification of pioneers in climate policy-making on a systematic and reliable empirical foundation, which adequately quantifies the stringency of climate policies and captures changes over time. On the other hand, we aim at developing a statistical model that is capable of explaining why some governments lead and others lag behind in climate policies and why these observations change over time. For these reasons, we introduce and test in this paper a first and rough draft of an analytical framework for large-n statistical evaluations and explanations of cross-national differences in the stringency of climate policies and their variation over time. However, it is not our ambition to present a perfect model. Rather, we seek to test the principal feasibility of such an approach.

In the first part of the paper, we briefly review existing approaches to measure, compare, and assess statistically climate policy performance across countries. Based on this review, we propose and discuss a first draft for a comprehensive climate policy index that measures, compares, and ranks the pioneering role and stringency of climate policies of governments over time by means of several indicators for policy outputs. The index integrates different market-based, information-based, regulatory, and monetary instruments that affect sectors that significantly contribute to greenhouse gas emissions, namely industry, transport, household, and buildings. Its consistency and significance are then tested with data for 24 countries. This test confirms the observations of other studies and shows that nations not only differ in the stringency of their policies, but that these differences and accordingly the ranks vary over time and across sectors, too. In the second part of the paper, drawing on the capacity model for environmental policies conceptualized by Jänicke (1997), we derive a first and preliminary set of hypotheses on possible causes for the observed variations in the stringency of climate policies, operationalize these, and test their explanatory power with bivariate statistical analysis. Namely, we investigate the significance of differences in the political systems, administrative capacities, the actor configurations, the economy, the innovation capacity, and situative factors in explaining differences in the stringency of climate policy and their variation over time. We conclude with an overall discussion of the preliminary results and their implications for the refinement and adjustment of our analytical framework in the next steps of our research.

Comparing and measuring climate policy

Descriptive statistics of the performance of countries in tackling climate change, the stringency of national and international climate policies, and related rankings are typically based on the level of greenhouse gas reduction targets to which governments have committed themselves legally under the Kyoto Protocol or voluntarily and/or the actual progress in reducing greenhouse gas emissions, either measured as absolute reduction in carbon-dioxide emissions or relative to energy consumption, gross domestic product, or population size (e.g. Esty et al. 2006; Germanwatch 2005, 2006). However, these measurements are unsatisfactory for our purpose to determine statistically whether a government leads or lags behind in national and international climate policy-making, whether it is a pioneer or a laggard.

To measure the stringency of climate policies against national greenhouse gas reduction targets is unsatisfactory, since their actual stringency strongly depends on national circumstances, such as economic growth and structure, level of economic and technological development, population structure and growth, or climatic conditions (cf. IPCC 2001b; IPCC 2001a, 2001c; see also the discussions on equitable burden sharing and the general assessments of the Kyoto Protocol targets, e.g. in Ringius et al. 1998; Groenenberg et al. 2004; Grubb et al. 1999; Böhringer 2003). For example, in the framework of the EU greenhouse gas reduction target under the Kyoto protocol, the so called *EU bubble*, Germany is legally committed to—and likely to achieve—an at first sight ambitious reduction of its greenhouse gas emissions by 21 percent in the first commitment period (2008 to 2012) as compared to 1990 levels. This goal, however, appears in a fundamentally different light, if it is taken into account that when it was decided in 1998 an already significant reduction of greenhouse gas emissions of 15.6 percent was achieved, which above all resulted from the economic collapse of industrial production in the new federal states after reunification (Michaelowa 2003; Ziesing 1996; see also EEA 2006). Even when the greenhouse gas reduction targets are adjusted to such national circumstances, e.g. through the so called *triptych approach* (Phylipsen et al. 1998), they rather indicate the ambition of a country and less the actual stringency, since they tell little about the strictness of the actual policy efforts and implementation measures that the country adopted to achieve this goal. In the worst case, these goals may be no more than mere lip service. Binder and Tews (2004) reveal that such goals may be abandoned or lack implementation.

To measure the stringency of climate policies against the actual progress in reducing absolute or relative greenhouse gas emissions is unsatisfactory, too, since there is hardly a direct causal link between an increase or decrease of greenhouse gas emissions and climate policies or, more generally, environmental policies. In other words, significant absolute or relative greenhouse gas reductions are not necessarily the result of climate and other related environmental policies, but can have a number of other causes, notably economic developments, technological innovations, demographic factors, weather, etc.. The establishment of a precise causal link between policies and ecological impact is a general problem in policy evaluations, be it at the international level, e.g. the effectiveness of international regimes (cf. Helm and Sprinz 2000; Jacobeit 1998) or at the national level, e.g. the effectiveness of domestic environmental policies (cf. Bartlett 1994; Jänicke and Weidner 1997b; Jänicke 1996). Again, the significant greenhouse gas reduction in Germany due to the economic collapse of industrial production in the new federal states after reunification is an obvious example to illustrate the shortcoming of these measurements. Eichhammer et al. estimate that by 2000 reunification accounts for 60 percent of the greenhouse gas reduction, measured as absolute decrease of carbon-dioxide emissions, in Germany since 1990 and were, thus, not induced by climate or environmental policies (Eichhammer et al. 2001:1). Likewise, the greenhouse gas reduction in the United Kingdom by 12 percent between 1990 and 2000, again measured as absolute decrease of carbon-dioxide emissions, was found to be mainly caused by the liberalization and privatization of the electricity market and could only partially attributed to climate and environmental policies (Hammons 2006; Eichhammer et al. 2001). At the global level, Esty et al. (2006) find that when measuring performance in climate policies as progress in the absolute reduction of carbon-dioxide emissions in particular the poorest nations without ambitious climate policies rank first and observe that the "most 'successful' countries all achieved their emissions reductions by means of economic collapse rather than a focused [greenhouse gas] control policy" (269). Unfortunately, when measuring relative reductions of greenhouse gas emissions, e.g. by calculating changes in carbon-dioxide emissions relative to energy consumption, the gross-domestic product, or the population size, the problem persists that observable reductions can be hardly linked to climate or environmental policies.

In sum, none of these measurements captures actual *climate policies and implementing measures* of governments and their differences, but compares either *political intentions and ambitions* of governments in tackling global warming or *changes in polluting activities and pollution levels* in a country irrespective of whether they have been policy induced or not. Against this background, we decided to develop an index that measures policy outputs. Of course, the measurement of climate policy performance by means of output indicators partially shares the deficiencies of measurement through reduction goals, because the implementation of policies and measures might be incomplete or they might simply prove ineffective (cf. for a discussion of these problems in the evaluation of the effectiveness of international regimes Helm and Sprinz 2000; Jacobeit 1998). However, in contrast to goals these deficiencies can at least be reduced by a selection of such policies and measures that are hypothesized in the relevant policy literature to be effective (e.g. IPCC 2001b) and that are mandatory or based on a formal decision of governments as opposed to voluntary commitments and mere declarations. On this basis, one can reasonably assume that the policy output is likely to affect the behavior of targeted actors and, as a consequence, ecological parameters.

Apart from these criteria, the actual selection of output indicators was guided by a combination of methodological with problem and climate policy related considerations. We started from the general assumption that to adequately capture a government's climate policy a comprehensive index must be conceptualized that integrates a broad range of different policies and instruments. Climate change is not only a challenge with possible global repercussion, it is characterized by "complex interactions between climatic, environmental, economic, political, institutional, social and technological processes" (IPCC 2001b:3). Almost any societal sector and literally all individuals contribute to the problem, since its main cause, the use of energy resources, constitutes the basis of almost any human activity. Consequentially, there is no single path to mitigate climate change, but an effective climate policy has to rely on a portfolio of policy instruments and target a broad range of actors and sectors in national societies (IPCC 2001b). Hence, unlike in other policy areas there is no single measurement of the policy stringency, as for example the stringency of social policies, which is largely determined by public spending, and therefore can be easily measured through public expenditures for social purposes. Therefore, the selection had to reflect that according to particular national circumstances the policy choices of governments as regards the preferred policies and instruments as well as the targeted sectors might vary considerable across countries (IPCC 2001b). Against this background, we sought to ensure that our index adequately captures the likely cross-national diversity of climate policies in terms of targeted actors and selected policies and instruments, but at the same time attempted to limit the number of indicators to a manageable set. Drawing on the comprehensive list of possible instruments and a discussion of their likely effects provided by the International Panel on Climate Change (cf. IPCC 2001b:412-422, see there also for further literature), we decided eventually to incorporate in our index market-based, information-based, regulatory, and monetary policies and instruments, namely tradable permits and taxes, labels, standards, subsidies, and expenditures for research and development, that affect the largest emitters of greenhouse gas emissions, notably energy, industry, transport, households, and buildings sector.

From a methodological point of view and given our analytical interest, we had to select indicators that allow measuring differences in the level of stringency and variations over time. However, a cross-national comparison of the stringency of climate policies and instruments over time is confronted with the methodological challenge that more often than not in different countries different methods of measurement or different bases of calculation apply that render a comparison, to put it mildly, extremely difficult (see for a general discussion of the methodological pitfalls in comparisons of environmental policy Holzinger 2006). This applies in particular to regulatory policies and instruments. Only market-based and monetary instruments, e.g. tradable permits, subsidies, taxes, and public expenditures, do not or at least not so severely suffer from these problems of comparability and are therefore incorporated in our index as measures for the stringency of climate policies and its evolution over time. However, a limitation to these instruments would have be at odds with our problem or climate policy related considerations to conceptualize a comprehensive index that integrates the variety of policies and instruments, because we would have excluded important other policies and instruments to mitigate climate change, namely regulatory but also information-based policies and instruments. Therefore we decided to integrate these policies and instruments and to measure cross-national differences in the presence of these policies or instruments and the date of introduction. Apparently, these criteria are not suitable to capture changes over time and differences in the level of stringency. Policies and instruments are hardly abolished once they are implemented although they might be amended (cf. Bauer 2006) and it is at best difficult to derive the level of stringency from the presence and date of introduction of a policy or instrument. Nevertheless, this crude proxy allows determining whether a government in principle pioneers or lags behind in climate policies, because it measures an early or late willingness and serious commitment to act. Against this background, our index distinguishes two groups of indicators: those that measure the stringency of climate policies and those that measure the pioneer role of a government in introducing policies and instruments.

In the actual selection of concrete indicators we eventually acted on the maxim to rely on such indicators where data is easily available and does not require own efforts to generate new data, since our ambition in this paper is above all to test the principal feasibility of such an index. Table 1 presents details on those indicators that we finally selected, arranged according to sectors and the two distinct groups of indicators, the methods, points in time, and units of measurements, the different weighting factors, and the main sources from which we derive information. The points in time (1992, 1997, and 2005) were selected because they were either close to important steps in the evolution of the international climate change regime (the adoption of the United Nations Framework Convention on Climate Change in 1992 and of its Kyoto Protocol in 1997) or were the latest available data (2005).

Table 1: Indicators describing climate policy stringency and pioneer role

	Level of stringency (over time)	Pioneer role	Sources
Industry	• Emissions trading measured as relative difference of annual allocation and emissions in base year (EU-15), or as relative reductions of the initially submitted national allocation plans mandated by the European Commission for new member countries (EU-10) (weighted: 1/2) • Taxes on energy measured as percentage of energy price for light fuel oil and low sulfur oil in 1992, 1997, and 2005 (weighted: 1/2)		CAN (2006), IEA (2006a), Saevrud und Wettestad (Sæverud and Wettestad 2006)
Renewable Energy	• Targets for the renewable energy share of energy production measured as percentage of total energy supply (weight: 1/3) • Public expenditures for research and development for renewable energies measured as percentage of gross domestic product in 1991, 1996, and 2004 (weighted: 1/3)	• Year of introduction of investment incentives, tax measures, incentive tariffs, voluntary programs, tradable certificates, and obligations for renewable energies (weighted: 1/3)	IEA (2004; 2005)
Energy efficiency	• Public expenditures for research and development for energy efficiency measured as percentage of gross domestic product in 1991, 1996, and 2004 (weighted: 1/1)		IEA (2005)
Households	• Number of energy efficiency labels and standards for 10 household appliances (refrigerators, freezers, dishwashers, clothes washers, clothes dryers, electrical ovens, lamps, air-conditioners, water heaters, boilers) measured in 1992, 1997, and 2005 as well as the time lag to first introduction of label or standard (weighted: ½) • Taxes on energy for households as percentage of energy price for gas and oil in 1992, 1997, and 2005 (weighted: 1/2)	• Year of introduction of energy efficiency labels and standards for 10 household appliances (weighted: 1/2)	Own collection IEA (2004; 2005)
Buildings	• Thermal insulation standards ranked on a stringency scale of 1 to 4, based on U-values and available expert evaluations of stringency in literature (weighted: 1/3) • Number of adjustments measured in 1992, 1997, and 2005 (weighted: 1/3)	• Year of introduction of thermal insulation standards (weighted: 1/3)	Own collection and Visier et al. (2003), WEC (2001), Eichhammer and Schlomann (1998)
Transport	• Taxes on diesel measured as percentage of price per liter (weighted: 1/2) • Taxes on unleaded fuel measured as percentage of price per liter (weighted: 1/2)		IEA (2006c; 2006b), OECD/EEA (2006)

Source: own illustration

Ranking countries

To rank countries, we calculated basically two different climate policy indexes: a composite climate policy index that integrates all indicators and sectoral sub-indexes that integrate the respective indicators in each sector. The composite climate policy index is calculated as the mean of all sectoral sub-indexes. For each sectoral sub-index, we first calculated quartiles for each of the indicator in the respective sector, since the indicators have different units and scales, before we averaged them—according to the weighting of each indicator shown above in Table 1—into an overall value for the sectoral sub-indexes. If data on one or several of the indicators for a country is missing, the respective sub-index is excluded from the calculation of the rank in the composite climate policy index for this very country. Moreover, to determine whether the ranks of countries change over time, we calculated in the same manner composite climate policy indexes for 1992, 1997, and 2005, which however do not integrate all indicators but only those for which data is measured over time. While these indexes are hence more time sensitive than the initial composite climate policy index, they are less complex because they lack, for example, renewable energy targets and the thermal insulation standards as indicators. We therefore regard the initial composite climate policy index as the more valid measure, whereas in future steps the composite climate policy indexes for 1992, 1997, and 2005 will be subject to further sensitivity analyses and a possible extension.

Table 2: Composite climate policy index and sectoral sub-indexes

Rank	Countries	Composite index	Industry	Renewable Energy	Energy Efficiency	Transport	Households	Buildings
1	**Finland**	1,6	2,4	1,4	1	1,7	1,9	1,3
2	**Sweden**	1,8	1,8	1,7	1	1,7	2,6	2
3	**Denmark**	1,9	2	1,7	3	1,7	1,9	1
4	**Germany**	1,9	1,3	2,5	3	1	1,9	2
5	**Netherlands**	2,0	3	2,2	1	2	1,1	2,7
6	**Norway**	2,0	1,5	2,5	3	2	2,0	1
7	**France**	2,1	3	2	.	1,3	2,2	2
8	**Switzerland**	2,2	4	1,3	2	2	1,8	2
9	**Italy**	2,2	2,4	1,9	2	2,3	1,7	3
10	**Canada**	2,3	.	3,1	1	3,7	1,9	2
11	**UK**	2,4	1	3,4	4	2	2,4	1,7
12	**Austria**	2,5	2,3	1,7	2	2,7	2,6	3,7
13	**Ireland**	2,6	3	3,1	2	2	2,3	3,3
14	**Japan**	2,8	2,5	3,2	1	3	4,0	3
15	**New Zealand**	2,8	.	2,2	3	4	2,8	2
16	**US**	2,8	4	2,7	2	3,7	1,8	.
17	**Belgium**	2,8	3,4	3,2	.	2	2,3	3,3
18	**Hungary**	2,9	1,3	3,6	4	3	3,6	2
19	**Spain**	2,9	2,5	2,6	4	3	2,0	3,3
20	**Greece**	2,9	2,5	2,9	.	3,7	2,2	3,3
21	**Portugal**	3,0	2,8	2,5	4	2	2,5	4
22	**Czech Re-public**	3,2	3,1	3,6	4	2,3	2,7	.
23	**Australia**	3,3	.	2,4	3	4	3,0	4
24	**Luxembourg**	3,4	3,8	3,4	.	3,3	4,0	2,7

Source: own illustration

The top five countries on the list are the Nordic countries Finland, Sweden, Denmark plus Germany and the Netherlands. Finland heads the list and performs well in the buildings sector, in renewable energy and in energy efficiency, but slightly poorer in the household and industry sectors. Sweden performs well (sub-indices 1 or 2) in all sectors, and in particular in R&D for energy efficiency. It falls back slightly in the households sector. Denmark performs very well in all sectors, except for energy efficiency, where it is in the lower half of all countries. It performs particularly well in the buildings sector. Germany is found on rank five. It is leading in the fuel taxes in the transport sector and ranks high in industry; it performs less well in R&D for energy efficiency and falls behind slightly in renewable energy. The latter is somewhat surprising, since Germany is often associated with leadership in supporting renewable energy. The main instrument in Germany is feed in tariffs for renewables. Yet, the tariffs are difficult to be compared as they have different features regarding the local wind conditions, degression, etc. In our dataset it is only considered if a country has a feed in tariff at all (alongside with other instruments). The poor representation of such instruments is clearly a weakness of our index. However, it is noteworthy that feed in tariffs in Germany are not exceptionally high compared with the few other countries for which data is available ((European Renewable Energies Federation and Worldwatch Institute 2005)). The Netherlands is among the leading countries in R&D spending for energy efficiency and for households, but only on medium positions in industry and buildings. The top five countries thus show some sectoral preferences, but in general pursue ambitious policies in almost all sectors each.

The five countries following are Norway, France, Switzerland, Italy and Canada. For Norway, we find a somewhat similar profile like Denmark, being among the most ambitious countries in the buildings and below average in energy efficiency. In addition Norway is ambitious in the industry sector. France is among the top countries in transport, but performs not so well in industry. Switzerland has a very good index value in renewable energy. Like for Finland this could partly be attributed to a high level of public spending, in hand with a high absolute target for renewable energy. It ranks very poor in industry[1]. Italy displays a rather balanced, good to medium performance across all sectors except for buildings. This seems to be typical neglected issue in Southern European countries, where it is of minor importance in the overall greenhouse gas emissions. Canada has a very good index value in energy efficiency. Yet it has one of the poorest index values in transport sector. Moreover, its performance in renewable energy is only medium. We were not able to calculate a sub-index for the industry sector, since no data are available or applicable on neither of its components: emission trading and taxes on oil in industry.

The United Kingdom is ranked eleventh. It is according to our measurement most ambitious among all countries in the industry sector. At the same time, the position in energy efficiency, but also renewable energy, is among the last countries. Following, Austria, is among the first in renewable energy, and performs well in industry. Except for the buildings sector it displays

[1] Note that the emission trading system is not considered for the period under consideration. The rank is computed from the tax level only.

a rather balanced performance. Ireland demonstrates a good performance in energy efficiency and in the transport sector.

Japan is found in rank fourteen. We find a very wide range of values for the sub-indices. While it performs excellent in energy efficiency, it performs poor in households, according to our measurement. This particular ranking exemplifies the bias in our measurement as Japan is not described very well by the chosen instruments (taxes on energy in the household sector, and mandatory labels and standards, while it introduced the very ambitious Toprunner Programme targeting household appliances, too).

New Zealand and the US follow. New Zealand is fairly good in renewable energy and buildings, but, like the US, has a poor rank in transport. No sub-index can be calculated for the industry sector, since an emission trading system is not in place, and data on taxes on oil in industry are not available. The US demonstrates a fairly good index value in households. The US pioneered energy efficiency labelling and households. In addition it is on a fairly good rank with respect to energy efficiency. Yet it is found as a clear laggard with respect to industry and transport. The buildings sector is not considered for it is in the responsibility of the states. Belgium has good index values in the transport sector and in the household sector but is well below average in the remaining sectors.

There are only two transition countries in our sample. Additional countries are Annex I countries, but are not covered in many of our data sets, especially if they are non-IEA countries. Hungary, according to our index, is on rank 20, the Czech Republic is on rank 24. Interpretation must be very careful for the transition countries, since ranking might be biased by incomplete data.

Among the last ranks, we find southern European countries Spain, Greece and Portugal which have similar profiles. All have a comparatively well index value for the industry sector. They have rather poor values in energy efficiency and buildings. The latter is not a first priority in these countries due to climatic reasons. Australia is on the second-last rank, with best rankings in renewable energy and households, followed by Luxemburg on the last rank.

The data shows sectoral preferences of countries for most countries. These findings have to be read with some care, for there is a slight instrument bias associated with different sectors: Some sectors, like renewables and energy efficiency are measured strongly in terms of public R&D budgets. Transport and industry on the other hand is measured in terms of taxes among other things. To some extent, this reflects portfolios of policy instruments by sector across Annex I countries as shown by (Simeonova and Diaz-Bone 2005)): In the energy sector, for example, research accounts for about 25%, and it is plausible that this plays the strongest role in energy efficiency and renewable energy. Yet some sectors might be biased. In industry, for example, the authors report a share of about 20% of voluntary agreements, not covered in our index.

Interestingly, the membership in the EU has hardly an influence on the position in our index. EU-15 countries take the first four positions, but at the same time countries from this group can be found also at the very bottom of the index. Norway, Canada and Switzerland are countries that reveal at least in some issue areas a high level, without being members of the EU at all. This great variance indicates that energy and transport policies remain to a large degree within the responsibility of the national level.

Next, we are interested in countries' changes in position over time. To analyse this, we compare the indices for the three periods as shown in table 2. Countries are ordered by their rank in the composite index.

Table 3: Composite climate policy indexes for 1992, 1997, 2005, and changes of countries in ranks over time

Rank	Country	Composite Index 92	Composite Index 97	Composite Index 05	Trend 05-92
1	**Finland**	2	2	1,7	+
2	**Sweden**	2,1	1,9	1,7	+
3	**Denmark**	1,9	1,8	1,8	~
4	**Germany**	2,3	2,5	2	~
5	**Netherlands**	2,6	2,1	1,6	++
6	**Norway**	2,3	2,4	2,4	~
7	**France**	1,8	2,3	2,3	-
8	**Switzerland**	2	2	2,3	-
9	**Italy**	1,5	1,8	1,7	-
10	**Canada**	2,7	2,8	2,6	~
11	**UK**	2,2	2,6	2,1	+
12	**Austria**	2,7	2,2	2,2	+
13	**Ireland**	3,2	2,9	2,7	+
14	**Japan**	3,5	3,1	3	+
15	**New Zealand**	3,8	3,4	3,2	++
16	**US**	2,6	2,8	3,1	--
17	**Belgium**	2,7	2,7	2,8	~
18	**Hungary**	2	2,7	3	-
19	**Spain**	2,7	2,8	3	-
20	**Greece**	2,3	2,5	3,1	--
21	**Portugal**	3	3,3	3,5	-
22	**Czech Republic**	3,3	3,1	3	+
23	**Australia**	3,1	3,1	3,4	-
24	**Luxembourg**	3,5	3,3	3,2	+

Source: own calculation

We observe deviations in the overall ranking of countries when comparing the composite index and the indices for the three periods. Most markedly, Italy performs best (with index values of 1.5 to 1.8) on the climate policy index in all three two periods, compared to its tenth rank on the composite index. We take this as an indication that our index measuring the stringency of climate policy over time favours a particular policy profile in this country, but interpret these results with care. While the two types of indices measure slightly different concepts, we would in principal expect robustness of the rankings.

When looking at the changes of the climate policy index across the three periods we find different trends. Some countries improved on the index value with a constant trend (e.g. the Netherlands and Japan, but also New Zealand) while others feature stronger positive trends in only one period (e.g. UK). Some countries performed mostly stable throughout the periods (e.g. Denmark), while yet another group constantly worsened its position (US and Greece).

The main source for policy change must be found in domestic factor, as the international policy development remains the same for all countries. The evolving international regime is an important factor to explain the adoption of policy innovations on the national level (Busch 2005). However, the data reveals that there is much room for manoeuvre and for deliberate choices at the national level.

As a next step we analyse the determinants of choices at the national level, applying a model of capacities for environmental policies.

Capacities for climate policy

The capacity model for environmental policies

To explain the relative position of a country, we draw on the model of capacities for environmental policies developed by Jänicke and Weidner (Jänicke and Weidner 1997a; Weidner and Jänicke 2002; Jänicke 1997). Jänicke (1997:8) distinguishes between "capacity, as a relatively stable condition of action, and its utilisation which leads to the subjective and situative aspect of environmental policy". The environmental capacity of a country, in this perspective, is constituted by the strength, competence and configuration of the governmental and non-governmental proponents of environmental protection and the specific cognitive-informational, political-institutional and economic-technological framework conditions. The utilization of capacities depends on the strategy, will and skills of the proponents and on the particular situative opportunities. These factors have to be related to the kind of the problem, i.e. its urgency as well as the power and resources of the target groups and the specific economic performance.

This framework has been widely used in empirical analyses and has been further operationalize (Jacobsson and Lauber 2006). Using this model in a comparative perspective, the following determinants were found as crucial factors for environmental policy development (Jänicke 1997, 2005; Weidner 2002): the establishment of sufficiently equipped and empowered governmental actors like environmental ministries, the degree of environmental knowledge and public awareness, especially media coverage, strong environmental NGOs and green enterprises, integrative capacity of a country through strong institutions for environmental policy integration and corporatist institutional structures, and, finally, economic growth, among a wider range of additional variables.

While these findings have enhanced our understanding of success factors of environmental policy there remains uncertainty about specific factors that determine the willingness and ability of states to adopt innovative regulations and policies. In addition, Srcuggs (2003:130) has argued, that the approach misses “microfoundation linking causes and effects”. Jacob and Volkery (2005) have built on this critique and have proposed six important components of the conceptual framework for further systematic cross-country analysis. Focusing on the capacity-related, not the situative or strategic, aspects of the model these are (1) the role of institutional veto players in a political system, since a large number of veto-players increases the difficulty of departing from the status-quo and thus national pioneering behavior in environmental policy, (2) the openness of the political system that determines the degree of difficultness for environmental interests to get access to the parliamentary and executive decision making process, (3) the influence of green NGOs, and of (4) green business, (5) supportive economic framework conditions and, (6) the role of international factors. They have further selected a set of variables that serve as proxies for the theoretical concepts. By means of statistical analysis, they narrowed this set to those proxies that are best able to explain climate policy.

In this paper, we built on this analysis and (1) test the narrowed, but supplemented set of variables against new data, especially on the part of the dependent variable and (2) enhance the analysis to additional aspects. More specifically, we take a first step towards explaining changes in position of countries. We do so by testing the influence of our explanatory variables on a country’s position during three periods. This implies that additional explanatory variables covering the respective periods are used. This also means we should enhance the focus to situative and strategic factors. With these variables, we expect to explain foremost the change of a country's position which we explicitly model by the changes in climate policy index between 1997 and 1992, between 2005 and 1997 and between 2005 and 1992.

We hypothesize the following relationships (expected impacts of single variables on high ambition in climate policy in parentheses are indicated as +/-):

A large number of veto-players increases the difficulty of departing from the status-quo. We select variables describing corporatism (integration score, (Siaroff, 1997)) (+), federalism (-) and a strong executive (executive dominance) (+) available from Lijphart (1999). In addition, we chose the index by the World Economic Forum Survey on environmental governance (Esty et al. 2005) as a proxy for overall capacity in environmental administration. The index comprises information of a broad range of aspects related to government regulation of different environmental concerns and is not very specific as regards implementation compared to standard setting as we have discussed elsewhere (Jacob et al. 2006). Moreover it should not be understood as reaching beyond state environmental policy.

The openness of the political system determines the degree of difficultness for environmental interests to get access to the parliamentary and executive decision making process: Among different indices available from the comparative politics literature, we chose the number of parties in parliament (+), the probability of a coalition government (more precisely, the opposite, i.e. the % of Single Party Government (-)) (+), the electoral threshold, i.e. the effective % of the vote a party needs for representation (+), and the share of green (Left-Liberitarian) votes (+) provided by Lijphart (1999) as proxies for this concept. All indices are measured as averages over a longer period of time (1970-1995) reflecting our aim to describe more stable characteristics of the political system.

Strong green NGOs enable the introduction of ambitious environmental policy. To test this hypothesis, we use the following proxy variables taken from Esty et al. (2005): Environmental Group Membership (+) and the number of local agenda 21 initiatives (+).

Strong green business enables the introduction of ambitious environmental policy. On the one hand, there is a structural component to this argument: Certain industries are CO_2 intensive like coal and oil industry on the one hand, and sectors which a much above average energy consumption, i.e. chemicals, pulp and paper, nonferrous on the other hand. Such industries would be losers of ambitious climate policy and thus mobilize against it. We capture this concept with several variables: the share of coal and oil in electricity production at three points in time (1980, 1990 and 2003) (-) as well as its relative change between 2003 and 1980 (-) (IEA/OECD 2005). In addition, we use a proxy for the interests of "dirty industries" – the share of 6 energy intensive industrial sectors in GDP (-) (Binder et al. 2001). On the opposite there are sectors that have a strong interest in climate policy, i.e. renewable industry business. On the other hand, there are manifold environmental, but not sector specific activities ongoing in the private sector. Among these are eco-auditing and sustainability rating. Selected proxies are the Dow Jones Sustainability Group Index (+) which encompasses a "group of companies that have been rated as the top 10% in terms of sustainability. Firms that are already in the Dow Jones Global Index are eligible to enter the Sustainability Group Index. Countries in which a higher percentage of eligible firms meet the requirements have a private sector that is contributing more strongly to environmental sustainability" (Esty et al. 2005:317). Secondly, we use the share of ISO 14001 certified enterprises (+) (Esty et al. 2005) and, third, an indicator on firms participating in sustainability rating, the average Innovest EcoValue rating of firms headquarted in a country (Esty et al. 2005).

Supportive economic framework conditions like economic growth and high GDP per capita as well as a low rate of unemployment are enabling structural factors. This link has been found in several studies on environmental performance and environmental policy (Esty et al. 2005). Yet it has always been pointed to the ambiguous effect of economic development. On the one hand it provides the necessary capacities for environmental policy on the other hand it is itself determinant of pollution. Thus the link is issue specific, and much dependent on the level of economic wealth. For a similar group of countries and the very same policy field, Jacob and Volkery (2005) found no significant correlation between economic conditions and the pioneering behaviour in climate policy. We are now interested whether we can establish this link for our new data and, whether economic conditions, especially economic growth and unemployment can explain the change in a country's position. As proxies, we use the variables economic growth (+), GDP per capita (+) and the rate of unemployment (-) (OECD, 2004). In addition, we account for the fact that economic conditions are determinants of pollution and as such determine the national costs and possibly welfare implications of ambitious climate policies. A high carbon economy will have a longer way to go than a highly efficient and low energy use economy. Thus we test for the impact of CO2 per GDP (-).

Greening of the Innovation System is an enabling factor for environmental policy: The indices for knowledge creation (+) and innovation capacity (+) are indicators from Esty et al. (2005) that portray broadly capacity developments in environmental science, technology and policy.

Finally, situative factors may open policy windows, by inducing a chance for proponents of environmental policy to bring new issues on the policy agenda. Such situative opportunities could be changes in the government, but also external or internal positively or negatively associated events such as natural disasters or scientific publications. We select at this point of the analysis two proxies: A change in government (Beck et al. 2001) for two periods of time: 2002 compared to 1997 and 1997 compared to 1993. Considered are changes of the participation of left parties in government.

Statistical analysis of determinants of climate policy ambition

Results of a bivariate correlation analysis are shown in table 4. Displayed are the correlation coefficients (Pearson's R), if for a pair of variables the correlation exceeds 0.3. The sample size is only n=17 for "Environmental groups, 1990", but is mostly close to the maximum sample size of n=24.

Table 4: Bivariate correlation analysis for seven factor groups with different indices of climate change policy

Capacity	Variables	All	1992	1997	2005	Change 05-92	Change 05-97	Change 97-92
Biased indicator?	Govt. revenue, % GDP, 2004	-.544**	-.523**	-.568**	-.524**			
	Govt. expenditure, % GDP, 2004	-.440*	-.589**	-.570**	-.504*			
Institutional veto structure	Integration	-.451*		-.508*	-.506*	.441*		.495*
	Federalism							
	Executive Dominance						.381	
	Government effectiveness	-.534**			-.446*	.515*	.416*	.407
	Environmental governance	-.712**		-.519**	-.648**	.557**	.487*	.409
Openness	Number of parliamentary parties	-.432*	-.461*	-.589**	-.496*			
	% Single Party Government			.411	.349			
	Electoral Threshold	.342		.591*	.471	-.314		-.469
	Green votes	-.551*	-.393	-.600*	-.501*			
Green NGOs	Environmental NGOs, 1990	-.446		-.518*	-.528*	.406		.359
	Local Agenda 21 initiatives, 2002	-.659**	-	-	-.501**			-
	Local Agenda 21 initiatives, 96	-.473*	-	-	-.423*			
	Local Agenda 21 initiatives, 02/96		-					-
Green Business	ISO 14001 cert. companies, 2002	-.431*	-	-	-.413*			-
	ISO 14001 cert. companies, 98		-	-.421*	-	.341		.513*
	ISO 14001 cert. companies, 02/98							-
	Dow Jones Sustainab. Group Index	-.573*	-.485*	-.478*	-.568*		.394	
	Innovest EcoValue rating	-.558**		-.457*	-.413*	.459*	.496*	
	Dirties_GDP	.677**	.398	.389	.350			
	Electricity from Oil + Coal1, 1980	.311						
	Electricity from Oil + Coal1, 1990	.393						
	Electricity from Oil + Coal1, 2003	.423	-	-			-.301	-
	Electricity from Oil + Coal1, 03/80		.566**	.465**	.347			
Innovation	Knowledge creation							
	Innovation Index	-.447*				.429	.305	.375
International engagement	Env. intergovernmental orgs.	-.554**	-.433*	-.439*	-.538**		.388	
	International env. Agreements	-.772**	-.531*	-.594*	-		.446*	
Economic conditions	GDP per capita					.395	.255	.367
	Growth, 2004/00	.372	-	-				
	Growth, 1997/92		-	.374		.337		
	Growth, 1989/85				-			
	Unemployment, 2003		-			-.406**		-
	Unemployment, 1993							
	CO_2 per GDP	.649**	.399	.610**	.615**			
Situative factors	Change of government 03_97		-	-				
	Change of government 97_93		-			-.323		-.314

* statistically significant at 0.05 level

** statistically significant at 0.01 level

\- not calculated due to mismatch of time periods

Source: own calculations

Given our presumption about a possible bias in our data portrayed above we start by a statistical analysis of this link. We test for a significant correlation of our indices of climate change policy and two variables describing (1) Total government revenue as % of GDP and (2) Total government expenditures as % of GDP (OECD 2005). We find systematic, significant correlations between these two indicators and all of our climate change policy indices, except for the changes in rank between the periods.[2] In view of this and lack of robustness of the indices all results should be read with care.

In general, we are best able to explain the composite index and we find only few significant correlations with the variable describing the change in a country's position.

Among the variables describing the institutional veto structure, we find correlations between the integration score and the climate policy index. The correlation carries the expected sign: A negative correlation indicates that a higher integration score is associated with a lower (better) score on the climate policy index. This holds for the composite climate policy index as well as the indices for 1997 and 2005 and for the changes in the climate policy index between 1992 and 2005 as well as 1992 and 1997. For the latter variables, the sign is opposite since they are defined as "improvements" in climate policy. Those countries that have a higher integration score where more likely to improve their rank in climate policy. We find no substantial or significant correlations between the climate policy indices and federalism or a strong executive. This is in line with the finding by Jacob and Volkery (2005). Among the variables more directly describing the veto structure, it is only the corporatism index that explains climate policy. This finding adds empirical support to several studies that found a positive link between corporatism and environmental performance, at least for issues related to pollution (Scruggs 2003) or climate policy (Jacob and Volkery 2005).

Government effectiveness, though not specific to environmental concerns, but to public administration in general, is likewise significantly correlated with the climate policy index for

[2] Before carrying on with our analysis, we therefore explored the option of correcting for this correlation in partial correlations. We found three good reasons against this procedure: (1) results do not change fundamentally, but we observe a tendency of several correlations becoming insignificant if correcting for the influence of the overall government expenditure/revenue. (2) government expenditure/revenue are correlated with several of our proxies for environmental policy capacity, e. g. the integration score and the environmental governance index. Therefore we cannot tell exactly tell which relation to correct for. A more systematic, multivariate analysis is foreseen for future research (3) Results are broadly in accord with findings by Jacob and Volkery (2005) who used a similar data set on the part of the independent variables, but a different dependent variable.

2005 as well as the composite index and for two of the three variables indicating change in position. Even higher and significant for all but the first period, is the correlation with the variable environmental governance. We understand this index as a proxy for state environmental capacity. The results thus support the hypothesis, that sufficiently equipped and empowered state governmental actors are crucial factors in climate policy.

Among the proxy variables describing the openness of the political system we find empirical support of the hypothesis that a larger number of parties in the parliament increases the chances of climate policy concerns to be addressed; whereas a higher share of single party governments would be expected to be associated with less ambition in climate policy, but not significantly correlated. The electoral threshold displays no substantial and significant correlations. A high share of green votes is associated with a higher for the full period. No relation is found with the change in position of a country. We find no significant correlations of variables in this block with the change in the climate change index.

The influence of green NGOs is positive as expected. We find that Membership in environemntal NGOs is significantly associated with a more ambitious climate policy in several periods. Membership in Local Agenda 21 initiatives is available for several years starting from 1996. We find significant correlations, but not so for the changes in membership.

Equally positive is the influence of green business: This link is found for several of the variables indicating the share of ISO 14001 certified firms at different points in time, and, in addition for the Dow Jones Sustainability Group Index and the average Innovest EcoValue rating of firms headquarted in a country. Several of these variables are, in addition, significantly correlated with the change in climate policy.

While green business seems to be a push factor in climate policy, there is also support for the hypothesis that carbon intensive industries are rather hindering the introduction of ambitious climate policy. A high share of "dirties" in industry is associated with poorer performance in climate policy. Moreover, while the share of electricity generated from oil and coal is not significantly associated with less ambitious climate policy, so is the change of this share between 2003 and 1980. However, the direction of this effect could be opposite, too. Due to rather loose climate policy, a shift in the energy system has not occurred. These variables are not substantially or significantly related to the change in countries' positions.

Among the variables indicating a greening of the innovation system the innovation index is significantly correlated with the composite climate policy index. This correlation increases to (R= -0.63**) and becomes significant for several of the three periods and the changes in position if we exclude the US from the analysis which has the highest score for this variable.

The international engagement of countries in different fields of environmental policy displays rather high and systematic correlations with climate policy. This allows the conclusions that strong engagement at the international level is complemented by national innovation behaviour and, in addition, is coherent across different policy fields.

Like Jacob and Volkery (2005) found before, GDP per capita and economic growth are not found to be supportive of climate policy ambition. They are not significantly correlated with climate policy in all but one bivariate relation. Though not significant, economic growth is even associated with less proactive climate policy; however, this result is strongly influenced by few countries with a rapid growth in recent years: the two transition countries in the sample (Hungary and Czech Republic) as well as Ireland and Greece.

Interestingly, we find different results of the economic framework conditions when comparing the absolute indices and the changes in position. While for all other groups of variables, the relations point in the same direction, it is the other way around for the economic variables: yet not significant, we find a positive association of GDP per capita and the improvement of the climate policy index. And, while unemployment is not significantly correlated with the absolute levels in the climate policy index, it is positively associated with the change in countries' positions: Countries that lost in rank between 1992 and 2005 would thus be characterized by higher unemployment rates in 2003.

Finally, countries with a high carbon intensive economy statistically have less ambitious climate policies.

Among the situative factors we do not find significant correlations among any of the variables. To substantiate this relation or possibly to find more relevant aspect, this complex surely needs additional attention.

References

Andersson, Magnus, and Arthur P.J. Mol. 2002. The Netherlands in the UNFCCC process - Leadership between ambition and reality. *International Environmental Agreements: Politics, Law and Economics* 2 (1):49-68.

Andresen, Steinar, and Shardul Agrawala. 2002. Leaders, pushers and laggards in the making of the climate regime. *Global Environmental Change* 12 (1):41-51.

Andresen, Steinar, and Siri Hals Butenschon. 2001. Norwegian climate policy: from pusher to laggard? *International Environmental Agreements: Politics, Law and Economics* 1 (3):337-356.

Bartlett, Robert V. 1994. Evaluating environmental policy success and failure. In *Environmental policy in the 1990s: towards a new agenda*, edited by N. J. Vig and M. Kraft. Washington, D.C.: Congressional Quarterly Press.

Bauer, Michael. 2006. Politikbeendigung als policyanalytisches Konzept [Policy termination in concepts of policy analysis]. *Politische Vierteljahresschrift* 47 (2).

Beck, Thorsten, George Clarke, Alberto Groff, Philip Keefer, and Patrick Walsh. 2001. New tools in comparative political economy: the database of political institutions. *World Bank Econ Rev* 15 (1):165-176.

Binder, Manfred, Martin Jänicke, and Ulrich Petschow, eds. 2001. *Green industrial restructuring. International case studies and theoretical interpretation*. Berlin: Springer.

Binder, Manfred, and Kerstin Tews. 2004. Goal formulation and goal achievement in national climate change policies in Annex-I countries. ffu-report 02-2004. Berlin: Environmental Policy Resarch Institute.

BMU. 2003. Enhancing Germany's pioneering role in climate protection. Press release 122/03. Berlin: Federal Ministry for the Environment, Nature Conservation and Nuclear Safety.

———. 2006a. Climate protection pays. Implementing and upgrading the Kyoto Protocol. Berlin: Federal Ministry for the Environment, Nature Conservation and Nuclear Safety.

———. 2006b. Statement by Sigmar Gabriel, German Minister for the Environment, Nature Conservation and Nuclear Safety on the occasion of the joint high level segment of the 12th session of the Conference of the Parties to the United Nations Framework Convention on Climate Change and the 2nd session of the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol. Berlin: Federal Ministry for the Environment, Nature Conservation and Nuclear Safety.

Böhringer, C. 2003. The Kyoto Protocol: a review and assessment. *Oxford Review of Economic Policy* 19 (3):451-466.

Busch, Per-Olof. 2005. Institutionalisierter Politiktransfer mit Nebenwirkungen: Die Ausbreitung von Quoten und Einspeisevergütungen. In *Die Diffusion umweltpolitischer Innovationen im internationalen System*, edited by K. Tews and M. Jänicke. Wiesbaden: VS Verlag für Sozialwissenschaften.

CAN. 2006. National allocation plans 2005-7: do they deliver? Key lessons to member states' for 2008-12. Brussels: Climate Action Network Europe.

Christiansen, Atle C., and Jørgen Wettestad. 2003. The EU as a frontrunner on greenhouse gas emissions trading: how did it happen and will the EU succeed? *Climate Policy* 3 (1):3-18.

DEFRA. 2006. The UK's Fourth National Communication under the United Nations Framework Convention On Climate Change. London: Department for Environment, Food and Rural Affairs.

EEA. 2006. Greenhouse gas emission trends and projections in Europe 2006. EEA Report 9/2006. Copenhagen: European Environment Agency.

Eichhammer, Wolfgang, Ulla Boede, Frank Gagelmann, Eberhard Jochem, Nicola Kling, Joachim Schleich, Barbara Schlomann, John Chesshire, and Hans-Joachim Ziesing. 2001. Greenhouse gas reductions in Germany and the UK. Coincidence or policy induced? An analysis of international climate policy. Berlin: Federal Environmental Agency.

Eichhammer, Wolfgang, and Barbara Schlomann. 1998. A comparison of thermal insulation regulations in the European Union. Karlsruhe: Fraunhofer Institute for Systems and Innovations Research.

Esty, Daniel C., Marc A. Levy, Tanja Srebotnjak, and Alexander de Sherbinin. 2005. *2005 Environmental Sustainability Index: Benchmarking National Environmental Stewardship* New Haven: Yale Center for Environmental Law & Policy.

Esty, Daniel C., Marc A. Levy, Tanja Srebotnjak, Alexander de Sherbinin, Christine H. Kim, and Bridget Anderson. 2006. *Pilot 2006 Environmental Performance Index*. New Haven: Yale Center for Environmental Law & Policy.

European Renewable Energies Federation, and Worldwatch Institute. 2005. Reflections on a possible unified EU financial support scheme for renewable energy systems (RES): A comparison of minimum-price and quota systems and an analysis of market conditions. EREF's position regarding enactment of a unified financial support scheme for the promotion of renewable energies in the "Europe-25". Brussels, Washington.

Germanwatch. 2006. *Climate Change Performance Index 2006. A comparison of the 53 top CO2 emitting nations*. Germanwatch 2005 [cited 11 November 2006]. Available from http://www.germanwatch.org/klima/ksi.htm.

———. 2006. *Climate Change Performance Index 2007. A comparison of the 56 top CO2 emitting nations*. Germanwatch 2006 [cited 11 November 2006]. Available from http://www.germanwatch.org/klima/ksi.htm.

Groenenberg, H., K. Block, and J. van der Sluijs. 2004. Global triptych: A bottom-up approach for the differentiation of commitments under the climate convention. *Climate Policy* 4 (2):153-175.

Grubb, Michael, Christiaan Vrolijk, and Duncan Brack. 1999. *The Kyoto Protocol: a guide and assessment*. London: Royal Institute of International Affairs, Energy and Environmental Programme.

Gupta, J. 1998. Leadership in the Climate Regime: Inspiring the Commitment of Developing Countries in the Post-Kyoto Phase. *Review of European Community and International Environmental Law* 7 (2):180-190.

Gupta, Joyeeta, and Michael Grubb, eds. 2000. *Climate Change and European Leadership: A Sustainable Role for Europe?* Dordrecht: Kluwer Academic Publishers.

Gupta, Joyeeta, and Lasse Ringius. 2001. The EU's climate leadership: reconciling ambition and reality. *International Environmental Agreements: Politics, Law and Economics* 1 (2):281-299.

Hammons, T. J. 2006. In-depth review of United Kingdom achievements under framework convention on climate change. *International Journal of Power and Energy Systems* 26 (2):171-185.

Helm, Carsten, and Detlef F. Sprinz. 2000. Measuring the effectiveness of international environmental regimes. *The Journal of Conflict Resolution* 44 (5):630-652.

Holzinger, Katharina. 2006. Methodological pitfalls of convergence analysis. *European Union Politics* 7 (2):271-287.

Huber, Michael. 1997. Leadership in the European climate policy: innovative policy making in policy networks. In *The innovation of EU environmental policy*, edited by D. Liefferink and M. S. Andersen. Oslo: Scandinavian University Press.

IEA. 2004. *Renewable energy. Market and policy trends in IEA countries*. Paris: International Energy Agency.

———. 2006. *2005 R&D statistics* [online database]. IEA database project 2005 [cited 11 November 2006]. Available from http://www.iea.org/textbase/stats/rd.asp.
———. 2006. *Climate change mitigation. Policies and measures* [online database]. International Energy Agency 2006a [cited 11 November 2006]. Available from http://www.iea.org/textbase/envissu/pamsdb/index.html.
———. 2006b. Energy prices and taxes. Paris: International Energy Agency.
———. 2006c. Oil Information - Product Supply and Consumption. Volume 2004: International Energy Agency.
IEA/OECD. 2005. Energy balances of OECD countries 2003-2004. Paris: International Energy Agency.
IPCC. 2001a. *IPCC Third Assessment Report. Climate Change 2001: Impacts, Adaptation and Vulnerability*.
———. 2001b. *IPCC Third Assessment Report. Climate Change 2001: Mitigation*.
———. 2001c. *IPCC Third Assessment Report. Climate Change 2001: The scientific basis*.
Jacob, Klaus, and Axel Volkery. 2005. Modelling capacities for environmental policy-making in global environmental politics. Paper read at 46th Annual Convention of the International Studies Association, 1 - 5 March, at Honolulu, Hawaii, USA.
Jacobeit, Cord. 1998. Wirksamkeit in der internationalen Umweltpolitik [Effectiveness in the field of international environmental policy]. *Zeitschrift für Internationale Beziehungen* 5 (2):345-366.
Jacobsson, Staffan, and Volkmar Lauber. 2006. The politics and policy of energy system transformation. Explaining the German diffusion of renewable energy technology. *Energy Policy* 34 (3):256-276.
Jaeger, Carlo C., Terry Barker, Ottmar Edenhofer, Sylvie Faucheux, Jean-Charles Hourcade, Bernd Kasemir, Martin O'Connor, Martin Parry, Irene Peters, Jerry Ravetz, and Jan Rotmans. 1997. Procedural leadership in climate policy: a European task. *Global Environmental Change* 7 (3):195-203.
Jänicke, Martin. 1997. The Political System's Capacity for Environmental Policy. In *National Environmental Policies. A Comparative Study of Capacity Building*, edited by M. Jänicke and H. Weidner. Berlin, Heidelberg, New York: Springer.
———. 2005. Trend setters in environmental policy. The character and role of pioneer countries. *European Environment* 15 (2):129-142.
———, ed. 1996. *Umweltpolitik der Industrieländer. Entwicklungen - Bilanz - Erfolgsbedingungen [Environmental policies in industrialized countries. Developments and success conditions]*. Berlin: Edition Sigma.
Jänicke, Martin, and Helmut Weidner, eds. 1997a. *National environmental policies: a comparative study of capacity building*. Berlin: Springer.
———, eds. 1997b. *Successful environmental policy. A critical evaluation of 24 cases*. Berlin: Springer.
Kennaway, R. 1999. New Zealand's international environmental policies: A case of leadership lost? *Round Table* (351):483-496.
Lijphart, Arend. 1999. *Patterns of democracy. Government forms and performance in thirty-six countries*. New Haven: Yale University Press.
Michaelowa, Axel. 2003. Germany—a pioneer on earthen feet? *Climate Policy* 3 (1):31-43.
OECD, 2005. *OECD in figures 2005*. Paris.
OECD/EEA. 2006. *Database on instruments used for environmental policy and natural resources management* [online database]. Organisation for Economic Co-operation and Development and European Environment Agency 2006 [cited 11 November 2006]. Available from http://www2.oecd.org/ecoinst/queries/.

Phylipsen, G. J. M., J. W. Bode, K. Blok, H. Merkus, and B. Metz. 1998. A Triptych sectoral approach to burden differentiation. GHG emissions in the European bubble. *Energy Policy* 26 (12):929-943.

Ringius, L., A. Torvanger, and B. Holtsmark. 1998. Can multi-criteria rules fairly distribute climate burdens? OECD results from three burden sharing rules. *Energy Policy* 26 (10):777-793.

Sæverud, Ingvild Andreassen, and Jørgen Wettestad. 2006. Norway and emissions trading: from global front-runner to EU follower. *International Environmental Agreements: Politics, Law and Economics* 6 (1):91-108.

Samson, Paul R. 2001. Canadian circumstances: The evolution of Canada's climate change policy. *Energy and Environment* 12 (2-3):199-215.

Sbragia, A. M., and C. Damro. 1999. The changing role of the European Union in international environmental politics: Institution building and the politics of climate change. *Environment and Planning C: Government and Policy* 17 (1):53-68.

Scruggs, Lyle A. 2003. *Sustaining abundance: environmental performance in industrial democracies*. Cambridge, Mass.: Cambridge University Press.

Simeonova, Katia, and Harald Diaz-Bone. 2005. Interated climate-change strategies of industrialized countries. *Energy* 30 (?):2537-2557.

Stern, Nicholas. forthcoming 2007. *The economics of climate change. The Stern review*. Cambridge, UK: Cambridge University Press.

U.S. Department of State. 2002. U.S. climate action report - 2002. Third National Communication of the United States of America under the United Nations Framework Convention on Climate Change. Washington, D.C.

UK Government. 2006. Climate change. The UK programme 2006. Tomorrow's climate, today's challenge. London: Her Majesty's Government.

Visier, Jean Christophe, Kirsten Engelund Thomsen, and Gudni Johanssen. 2003. Energy performance of buildings. Calculation procedures used in European countries. Vienna: Austrian Energy Agency.

WEC. 2001. *Energy efficiency policies and indicators. A report by the World Energy Council*. 2 vols. London: World Energy Council.

Weidner, Helmut. 2002. Capacity building for ecological modernization: Lessons from cross-national research. *American Behavioral Scientist* 45 (9):1340-1368.

Weidner, Helmut, and Martin Jänicke, eds. 2002. *Capacity Building in National Environmental Policy. A Comparative Study of 17 Countries*. Berlin: Springer.

Ziesing, Hans-Joachim. 1996. Energieverbrauch und CO2-Emissionen in Deutschland in der ersten Haelfte der neunziger Jahre. Weekly Report 4/96. Berlin: German Institute for Economic Research.

Appendix 2

Variable	Description	Source
Institutional veto players		
Integration	Integration score Mid 1990s	Siaroff, 1999
Federalism	Federalism Index (1970-1995), unitary (1,0) - federal (5,0)	Lijphart, 1999
Executive	Executive Dominance (1970-1995), weak executive (1,0) - strong (6,0)	Lijphart, 1999
Gov_Effectivness	Government Effectiveness (index)	Worldbank 2005
Env_Gov	World Economic Forum Survey on environmental governance	Esty et al. 2005
Openness of political system		
Elec_Threshold	Electoral Threshold (1970-1995) (effective % of the vote a party needs for representation)	Lijphart, 1999
Singleparty_Gov	% Single Party Government (1970-1995)	Lijphart, 1999
Parl_parties	Effective number of parliamentary parties (1971-1996)	Lijphart, 1999
Green_votes	2005 Environmental (Left-Libertarian) Average Vote Share1975-95	Lijphart, 1999
Green NGOs		
Env_Group	Environmental Group Membership World Values Survey 1990	Scruggs, 2003
LA21	Number of local agenda 21 (per million people) , 1996, 2002, 2002/1996	WRI, 2006
Green business		
Dow_Jones_SD	Dow Jones Sustainability Group Index	Esty et al., 2005
ISO14001	Number of ISO 14001 certified companies per billion dollars GDP (PPP), 1998, 2002	WRI, 2006
EcoValue	Average Innovest EcoValue rating of firms headquarted in a country	Esty et al., 2005
CO_2 per GDP	Carbon emissions per million US dollars GDP (2000)	Esty et al.,
Elec_OilCoal1980	Electricity Generation from Oil and Coal (%), 1980, 1990, 2003, Change 2004/1980	OECD, 2005
Supportive innovation system		
Knowledge_creation	Knowledge creation in environmental science, technology, and policy	Esty et al., 2005
Innovation_Index	Innovation Index 2003/04	Esty et al., 2005
International engagement		
Env. Intergov. Orgs.	Number of memberships in environmental intergovernmental organizations	Esty et al., 2005
International env. Agreements	Participation in international environmental agreements no participation	Esty et al., 2005
Economic framework conditions		
GDP_capita	Gross Domestic Product per capita, 2003 (current market prices, PPP, bn US$)	OECD, 2004
Growth	GDP growth, Average annual volume change, % 1989/85, 1997/92, 2004/00	Worldbank 2006
Unemployment	Unemployment rates Both sexes, % of civilian labour force 1993, 2003	OECD, 2004
Situative factors		
Changes in government	Changes in government from/to left party participation, 1997 compared to 1993, 2002 compared to 1997	DPI 2004, Beck, et al., 2001
Additional variables		
Govt_rev_GDP	Total general government revenue % of GDP, 2004	OECD, 2005
Govt_exp_GDP	Total general government expenditure % of GDP, 2004	OECD, 2005

Source: own compilation