The political economy of climate policy and energy systems transformation

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October 1, 2012

Introduction to the writing sample

Enclosed please find both an annotated table of contents for my dissertation, and chapters 3 and 4 in complete form. Chapter 3 reviews the politics of climate change mitigation and introduces a theoretical framework to explain when states might act despite strong incentives to free-ride. Chapter 4 then presents empirical evidence from the European Union's comprehensive climate change policy regime in support of this theory. I show that the structure of European policy is consistent with my claim that serious climate policy will target a coordinated transformation of the underlying energy system. I further show that Europe's climate policy generates an array of distributional consequences suggestive of an explicit attempt to use the technical tasks required of this transformation to generate near-term benefits. Those benefits, I argue, help build coalitions of economic interets, whose support helps sustain and expand future climate policy efforts.

These claims raise questions about how and where political interests and actors influenced climate policy formation. Chapters 5 and 6, available upon request, investigate those claims in the interest group dynamics and legislative history of Europe's major 2008 climate and energy policy reforms. Chapter 5 demonstrates that structure of expressed interests among major European economic actors reflects the influence of Europe's legacy energy systems as predicted in chapter 3. I further show that the pattern of economic interests in the energy system opened possibilities for the Commission to adapt the tasks required of emissions reduction for generating near-term economic benefits. Furthermore, the specific instruments used to achieve those tasks align with policy domains of common salience to otherwise opposed interests. This evidence reflects the intent to serve broad coalitions through the choice and design of specific policies.

Chapter 6 then shows that these benefits were the product of specific policy intentions within the European Commission, rather than bargaining in the legislative process. Using new computational and quantitative methods of my own design to study that legislative history, I show that the Commission's legislative proposals survived the legislative process largely unscathed. This result is consistent with qualitative evidence that the Commission explicitly protected its policy proposals from Parliamentary attempts to alter core components of the policy package. Instead, my evidence shows that Parliamentary changes were relegated to policy domains tangential to the tasks central to Europe's low-emissions energy systems transformation, and the politically-useful benefits they created.

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3 The political economy of climate change reconsidered

3.1 Introduction

A global, binding agreement on climate change mitigation has proven ephemeral. In its absence, unilateral state action on emissions reduction should be highly improbable. Climate change mitigation imposes potentially large costs, faces acute technological uncertainty, and delivers benefits largely in the form of global public goods. The resulting incentives for free-riding on the actions of others should provide few incentives for individual state action, even as it also interferes with attempts to bind the major emitters into a common framework.

Nevertheless, individual states or small groups of states have adopted a variety of climate policy measures in spite of the lack of a global climate treaty. These range from incremental efforts like research and development on low-emissions technologies, to comprehensive emissions control regimes. The states pursuing these measures include both advanced industrial democracies and developing economies: The European Union has a comprehensive emissions control regime; South Korea has published a wide-ranging "green growth" economic development strategy; China is the world's largest market for renewable energy goods; India has an ambitious solar electricity program; Brazil operates the world's largest fleet of alternative-fuel vehicles, run on ethanol produced very efficiently from sugarcane. Surprisingly, many of these efforts were redoubled after 2008, despite the onset of the worst global economic crisis since the Great Depression.

Unilateral state action in spite of weak or nonexistent global coordination defies a view of climate change that emphasizes the creation of global public goods via the resolution of negative environmental externalities. Resolving this dilemma poses two questions for political science. First, *when* would we expect states to act in the absence of a global framework; and second, *how* would we expect states to implement an emissions control regime? The first question asks why states would take action that apparently risks the growth and competitiveness of their domestic economies relative to free-riding competitor states; and the second questions how they would do so given the politically difficult task of imposing acute costs on powerful economic interests.

This chapter presents a theoretical framework for the political economy of climate change mitigation that resolves the apparent contradiction of state action in the face of very large incentives for political stasis and free-riding. It argues that the pattern of individual state action on climate change depends on whether states can link emissions policy to other energy policy domains that produce near-term, tangible, private benefits to action. Those benefits provide the means of securing a policy bargain among major economic actors, assist in resolving the distributional conflicts that arise from significant emissions reduction, and generate new interests in favor of long-term policy continuity.[1]

Whether states can find viable issue linkages depends, in turn, on the the structure of national energy systems and the corresponding tasks required to shift the energy system to a low-emissions trajectory. Fossil fuel use generates nearly 70% of global emissions even as it also provides the foundation of modern industrial economies. The

[1] Urpelainen (2012b) presents a parallel model of a "technology fund" in which developed-country actors provide subsidies to developing countries to buy low-emissions technologies, as an implicit subsidy to developed-country technology firms. Participation among multiple developed countries may be secured, he notes, though linkage across technologies rather than issue areas. Here, I argue that absent such a fund, a multiplicity of climate policy instruments may accomplish the same ends through different means.

physical, economic, and regulatory structure of legacy energy systems thus shapes the costs and benefits of emissions policies for the entire economy. As such, it influences whether those policies can offset the costs of emissions reduction through the generation of benefits from other energy-related domains like energy security, economic competitiveness, or high-technology innovation.

Treating climate change mitigation as a problem of energy systems transformation provides substantially more analytic leverage over the climate problem than more traditional approaches based in environmental politics. As this chapter will show, the complexity, cost, and uncertainty surrounding the transition to a low-emissions economy are unlike anything encountered in other environmental issues to date. While the environmental movement has been vital to publicizing the issue of climate change, social movement dynamics and public opinion are poorly suited to the maintenance of long-term and potentially costly policy in the face of strong incentives to the contrary. Instead, viable emissions policy will require a durable coalition of industry and labor, similar to that of large-scale industrial policy measures. Understanding whether and how that coalition may emerge amidst legacy structures for energy production, distribution, and use in industrial economies provides a vital contribution to the analysis of climate policy action.

This chapter proceeds in three steps. I first summarize the concept of energy systems transformation and the political economy challenges it creates. I then present a model of when and how individual states or regions would embark on a low-emissions energy systems transformation in the absence of a binding global emissions deal. I show that this model helps explain today's pattern of action and inaction on climate change, and offers analytic leverage on the question of how state action will evolve in the future. Subsequently, chapter 4 provides empirical evidence from the European Union, home to the world's most comprehensive climate change policy regime, that supports the conclusions of this model and demonstrates the potential for issue linkage mediated by the structure of regional energy systems and the demands of systems transformation.

3.2 Climate change and systems transformation

Climate change itself is essentially an externality problem coupled to a collective action problem operating at global scale. In this, climate change closely resembles other emissions-related pollution problems like acid rain or ozone depletion. Each of these have been successfully solved in the past through a mixture of national and international action to either incentivize or mandate emissions reduction.

However, the scope, scale, and complexity of climate change mitigation dwarfs these earlier examples of successful environmental policymaking. The majority of emissions result from fossil fuel use. Unlike the emissions that caused acid rain or ozone depletion, greenhouse gas emissions are inseparable from fossil-fuel-based energy production. But since fossil fuels provide the energy backbone to modern industrial economies, elimination of fossil fuels, or radical changes in their use, pose profound challenges to economic prosperity that were not present in earlier emissions-related environmental problems. Moreover, as Hanemann (2009) has shown, the technological uncertainty surrounding low-emissions alternatives to fossil fuels has no precedent in environmental policymaking. For both acid rain and the ozone hole, policy had to incentivize industry to switch to existing low-emissions technologies with well-understood technical and economic characteristics. Furthermore, adopting those technologies required no complementary changes elsewhere in the energy system or the economy. In contrast, most of the technologies required to achieve 50-80% reductions in absolute emissions levels do not yet exist, and substantial uncertainty surrounds both the technologies themselves and their downstream consequences for the economy at large.

This implies that serious climate change mitigation will require the transformation of modern energy systems and the economies they power. Those systems are made up of the assets, markets, and regulatory frameworks that govern energy production, distribution, and use. Their transformation implies a set of complementary and parallel changes in each of these areas, such that new low-emissions energy sources can function as viable choices to power industrial economies. Accomplishing these changes will require significant investment in new technology and infrastructure, the abandonment of otherwise functional capital, and a range of regulatory and behavioral changes to accommodate the very different operating characteristics of low-emissions energy sources.

Consequently, successful energy systems transformation will require a durable and flexible policy regime capable of shaping the evolution of the system over a long period. Given the anticipated duration of climate change mitigation efforts, political sustainability will matter as much as economic efficiency to a successful climate change policy framework. This section summarizes the ensuing political economy of climate change and energy systems transformation and its implications for such a policy regime. The following section takes up the question of when and how states would act in the context of the challenges and opportunities created by energy systems transformation. As I will show, the character of the energy system itself plays a powerful role in shaping the possibilities for implementing and sustaining comprehensive emissions reduction policy.

3.2.1 Emissions reduction through systems transformation

Climate change and climate change mitigation poses severe problems of global collective action and public goods provision. A limited set of individuals and countries benefit from activities that produce emissions, but don't pay the cost of those emissions. Because they can privatize the gains while socializing the costs, they face attenuated incentives to change that activity, even as their actions do real damage to the world around them. Resolving the emissions problem thus implies the imposition of large costs on relatively acute and well-organized actors who derive substantial benefits from emitting activities. But because the benefits of action arrive in the distant future, in the form of public goods enjoyed by all, climate policy creates few equally powerful interests in favor of sustaining policy in the face of this opposition.

Most analyses of the political economy of climate change mitigation concentrate on how to cajole states to act in spite of these problems of free riding, public goods provision, and concentrated and powerful opposition. But as chapter 2 showed, the bulk of the mitigation activity will occur inside the energy system–the assets, markets, and regulatory frameworks that structure how energy is produced, distributed, and used. That has two consequences for climate action. First, energy systems in most countries share a set of generic characteristics that will complicate policy action. Second, however, these systems also display considerable cross-national diversity within these common physical characteristics. This diversity suggests a varied set of opportunities and constraints for policy action. As section 3.3.2 will show, that variation is critical to the potential for issue linkage strategies that stabilize climate policy by linking it to near-term improvements in other energy-related policy domains.

Energy systems transformation presents a generic set of challenges grounded in the problem of introducing and optimizing a new energy carrier. New energy carriers, even if they produce heat or electricity indistinguishable from old sources, have very different physical characteristics that require a range of changes to accommodate. Coal and wood both produced heat for cooking, but coal had to be isolated from food lest its toxic fumes poison the food. Coal and oil could both fire steam engines, but oil needed an entirely new engine design–the internal combustion engine–to exploit all its potential. In practice, this means both that an energy system develops to optimize around the physical advantages and limitations of its current sources; and that those optimizations may be impediments to the introduction of new energy sources.

Industrial economies have encountered these challenges several times in the past.

Since the dawn of industrialization, at least four prior transformations have occurred: from wood to coal, from coal to oil, from oil to gas, and electrification. As Smil (2011) shows, each of these transformations required a plethora of parallel and complementary innovations, supported by substantial experimentation and investment across the entire energy system, to successfully incorporate new energy carriers as viable energy sources. The scope and range of activity meant that these prior transformations each took a long time to complete: nearly 200 years for coal and 75 each for oil and electrification.

These changes were not confined to the physical infrastructure of the energy system. Rather, the markets for energy and the regulatory frameworks that structure those markets had to change as well. The history of municipal gas and electricity markets in particular make clear the interplay of innovations in physical asset structure and evolution in regulatory systems. Troesken (1996) shows how the tendency of service-maximizing local politicians to use private utility firms' fixed assets to pressure them into unprofitable service extensions gave rise to public utility development that mixed monopoly rights with guaranteed service provisions. Hughes (1962) demonstrates how the choice of inappropriate regulatory regimes for new electrical grids delayed British electrification despite access to the same technologies, experience, and in many cases individual firm managers and engineers that had built the successful American system. In all cases, energy systems transformation went well beyond merely deploying new technological innovations and physical infrastructure.

But while a low-emissions energy systems transformation has precedents in these earlier transformations, it will encounter three additional problems that increase the difficulty, cost, and risks to serious emissions reduction. First, all prior transformations pursued superior sources: coal has higher energy density than wood and could be transported longer distances than charcoal. Oil had greater density than coal and could power lighter, more efficient internal combustion engines. Electrification permitted the concentration of power generation, its long-distance transmission, and its use in an entirely new class of small and high-powered motors that allowed the radical restructuring of production lines and led to substantial productivity increases.(Perez, 1983) It also could function as both an energy and an information carrier.

In contrast, the "green" electrons generated by renewable energy sources are at best equivalent to the "brown" ones they replace. The source of the energy carried by electricity is indistinguishable to the user. But renewable energy in the near term will be more expensive than fossil fuel. Furthermore, whereas fossil fuels produce constant, highly controllable energy supplies, renewable energy sources like wind or solar power vary naturally with wind speed and solar intensity. To avoid disrupting an energy system reliant on constant and predictable supplies of power, a range changes to energy distribution and use must occur to buffer intermittent energy generation technologies.[2] These changes can include the use of storage technologies to smooth production over time, the enlargement of transmission networks to average intermittency over larger geographic areas, the development of capacity markets to ensure sufficient backup generation capacity[3], and the use of so-called "demand-response" technologies that actively manage demand against supply to maintain systems stability. Regardless of what changes are adopted, however, they all imply substantial investments, regulatory and market reform, and behavioral change to maintain, rather than enhance, the stability and function of the energy system. The lack of novel advantages from low-emissions energy deprives the present energy systems transformation of the intrinsic motivations that drove earlier transformations, and increases the cost and complexity of emissions

[2]The Integration of Variable Generation Task Force (2009) estimates that intermittency becomes a problem when renewable energy contributes 20% or more of the electricity in an energy system. Empirical evidence from high-renewable-energy-share economies like Denmark or east Texas confirms these estimates.

[3]Capacity markets are markets that reward the provision, rather than use, of energy generation capacity. Usually, owners of generation assets are paid by selling electricity into the power grid. But buffering renewable energy intermittency may require generation assets that are used only rarely–during a particularly cloudy summer, for instance. In that case, some mechanism for incentivizing the construction of rarely used but vital generation capacity is required. For a summary of capacity markets and the issues involved in setting them up, see Cailliau et al. (2011), Gottstein and Schwartz (2010), and Joskow (2006).

reduction.

Second, earlier transformations could build new systems as complements to existing systems. But a low-emissions energy system seeks to replace rather than supplement the high-emissions status quo. This has both technical and political implications. Technically, firms and regulators will have fewer opportunities to experiment with the operation of large-scale systems based on new technology. Politically, substituting in low-emissions energy will mean the replacement of otherwise viable energy assets. The write-off of large capital costs in response to policy mandates generates acute interests opposed to emissions reduction that will demand compensation.

Third, the transformation of the electrical system will occur within an already-defined, highly networked system. As Katz and Shapiro (1985, 1986, 1994) show, such systems tend towards technological inertia through the positive externalities created by large networks, and through the natural monopolies they tend to generate. These factors distort the innovation process, raise the possibility that markets will select sub-optimal technical solutions, and threaten an outcome where short-term but ultimately insufficient solutions crowd out approaches that will prove viable in the long term. These difficulties in inventing and deploying new technology will appear, moreover, in an industry that already has one of the lowest rates of research and development investment of any capital-intensive sector in the economy.(American Energy Innovation Council, 2010)

In short, a low-emissions energy systems transformation faces a much more challenging technical and economic problem than earlier systems transformations, in a far more complex technical, economic, and regulatory environment. Moreover, the transformation must occur without interrupting the energy system's ability to power the industrial economies that depend on it. Achieving significant emissions reductions will thus put significant burdens on wealthy and powerful economic interests in the energy sector, and generate correspondingly higher energy prices throughout the economy. But without the intrinsic incentives of earlier transformations, this opposition will not be countered by new interests that accrue acute economic benefits from the adoption of renewable energy.

This set of characteristics poses profound political economy challenges. The cost of transformation will fall acutely on powerful interests, and will generate sympathy for them from energy users throughout the economy. The technical and economic characteristics of the new system lack obvious economic advantages that would create equally strong interests in favor of systems transformation. Thus a low-emissions energy systems transformation will require a durable and supportive policy framework, but that policy framework creates a set of highly motivated opposing interests without creating an equally strong set of interests in favor of policy continuity. The problems of energy systems transformation thus compound the difficulties implicit in the political economy of climate change mitigation, by raising the cost, risk, and complexity of providing ostensibly global public goods.

3.3 Towards a political economy of low-carbon energy systems transformation

Emissions reduction via energy systems transformation thus poses very significant barriers to policy action. It lacks the natural incentives that earlier energy system transformations enjoyed. It faces profound technological uncertainty. The changes required must occur though highly networked, monopolistic, and inertia-prone markets. And the interests displaced by emissions reduction are wealthy and well-connected, and stand to benefit from the sympathies of many energy consumers dissatisfied by higher energy prices. Meanwhile, the primary benefits from climate change mitigation arrive far in the future, and in the form of largely intangible global public goods that accrue to everyone regardless of their contribution to emissions reduction. This pattern of costs and benefits has regularly forestalled coordinated global action on climate change, and offers little reason to expect unilateral action.

Empirically, however, some states have adopted emissions reduction measures of varying degrees of ambition and comprehensiveness. State action in the face of apparently overwhelming incentives to the contrary poses two questions that cut to the core of the comparative political economy of climate change mitigation:

1. When should we expect states to institutionalize climate change action?
2. How should we expect states to institutionalize a policy framework for climate change action?
3. What would have to occur to fundamentally change the answers to (1) and (2)?

This section provides a framework for answering these questions, grounded in a theory of the political economy of energy systems transformation. I show that while alternative explanations for state action reliant on public opinion, party structures, or bureaucratic entrepreneurship provide some insight into state action, their predictive value is limited in both time and space. Resolving the contradiction between action on emissions reduction and the problem of global public goods requires looking beyond political processes to the way in which domestic energy systems structure and distribute the costs and benefits of climate change mitigation.

3.3.1 Postmodernism, greens, and bureaucratic ambition

Theoretically, the literature has suggested three explanations for variation in individual state willingness to adopt and institutionalize greenhouse gas emissions reduction. The "post-modern politics" thesis suggests that non-material goods have taken precedence over ever-growing material prosperity in sufficiently wealthy countries. In this view, emissions reduction represents a kind of consumption good attractive to citizens in wealthy advanced industrial economies.[4]

A second argument has suggested that this preference for non-material goods is particularly well-expressed where green parties have established themselves and provided single-issue representation in national parliaments. Jacobsson and Lauber (2006) pursue that notion in their explanation of Germany's transition towards a favorable environment for renewable energy adoption. They argue that German adoption of renewable energy emerged as a fight between the Energy ministry, allied to the fossil fuel sector, and the Environment ministry, backed by an increasingly powerful green party. Green parties in this argument embody a particular desire for environmental goods that may be willing to make explicit trade-offs of material consumption for improved environmental outcomes.

Finally, scholars have pointed to bureaucratic entrepreneurship in seeking issues to exploit for institutional gain. The high profile of the international climate change negotiations provided a potential venue for bureaucrats to exercise additional power outside domestic economies, or to establish new international roles. Promoting climate change mitigation at home may thus provide credibility for bureaucrats hoping to exercise power or autonomy abroad. Schreurs and Tiberghien (2007) suggest that this played an important role in the EU, where the European Commission sought a defining issue for its new foreign policy role after the passage of the Lisbon Treaty.

In practice, however, these three explanations offer an incomplete explanation for empirical patterns of climate change action. The new member states in Eastern Europe display far more conventional political preferences than their postmodern western

[4]The existence and strength of a "postmodernist" effect on attitudes towards environmental protection goods was confirmed by Diekmann and Franzen (1999), contrary to the results of Dunlap and Mertig (1995) and related work. Bättig and Bernauer (2009) find evidence that democracy increases citizens' expressed commitment to climate change mitigation, though that commitment rarely translates into actual changes in emissions levels. Gerhards and Lengfeld (2008) find that the relatively wealthier countries of the EU-15 support EU climate policy at higher rates than citizens of the new member states. The debate tracks with the left-libertarian realignment of European politics proposed by Kitschelt (1994), who argues that high levels of socioeconomic welfare have led disputes over non-economic goods to reassert their influence over late 20th-century European party identification.

European counterparts, yet those states supported the 2008 Climate and Energy package. China and India are relatively poor and have weak or nonexistent green parties, yet both have ambitious goals for renewable energy adoption. Finally, EU policy entrepreneurship proved disastrous at the Copenhagen climate talks, where the EU was largely shut out of final negotiations. But the EU has shown few signs of changing its long-term approach to climate and energy policy at home.

Furthermore, these explanations offer relatively few predictions of what states will do in the future. Victor (2011) has characterized today's landscape as one of "enthusiastic" and "reluctant" states. In the language of postmodern altruism and wealth, that typology should at least include a "skeptical" category for countries like the US, who have the wealth to act but not the will; and "vulnerable" for those whose vulnerability to climate damage makes them desperate for action even as they lack resources or international influence to promote or force it. Given the variation in postmodern altruism and the resources to do something in response, that implies a landscape something like figure 3.1.

But this typology, like the factors that underpin it, says little about how states will evolve over time. Will China, India, and Brazil become more like the US or the EU as they climb the income ladder? China has, for instance, become rather less recalcitrant in international negotiations over time, without either developing green parties or displaying much in the way of post-materialist values. Likewise, a framework based solely on political values and party relations provides little insight as to whether the present American reluctance to act on climate change a product of momentary political spasms, or of deeper American economic and environmental interests.

Finally, on a more practical note, these explanations offer limited guidance as to how policy could be implemented or sustained in light of the barriers and setbacks observed to date. Even in rich, liberal states, preferences for climate change policy have proven volatile, often for reasons wholly unrelated to the climate change problem itself. For instance, Egan and Mullin (2011) provide evidence that extreme weather events, which individually provide no information on long-term climate trends, may significantly affect citizens' attitudes towards climate change policy. Likewise, the US has consistently failed to adopt climate policy despite periods of significant political support. Climate policy dependent on the postmodern altruism of rich, liberal countries would thus appear to offer little promise of gaining or sustaining much traction in the face of its potential costs and risks.

The range of observed variation within the group of ostensibly "enthusiastic" states suggests the limits to hypotheses reliant on public opinion and party structures. Likewise, the range of policy action observed across "enthusiastic" and "reluctant" states suggests the limits to these categories themselves both now and in the future. Explaining both why states have acted, and how they have chosen to act, needs to look beyond these factors and categories to understand state interest formation on emissions reduction.

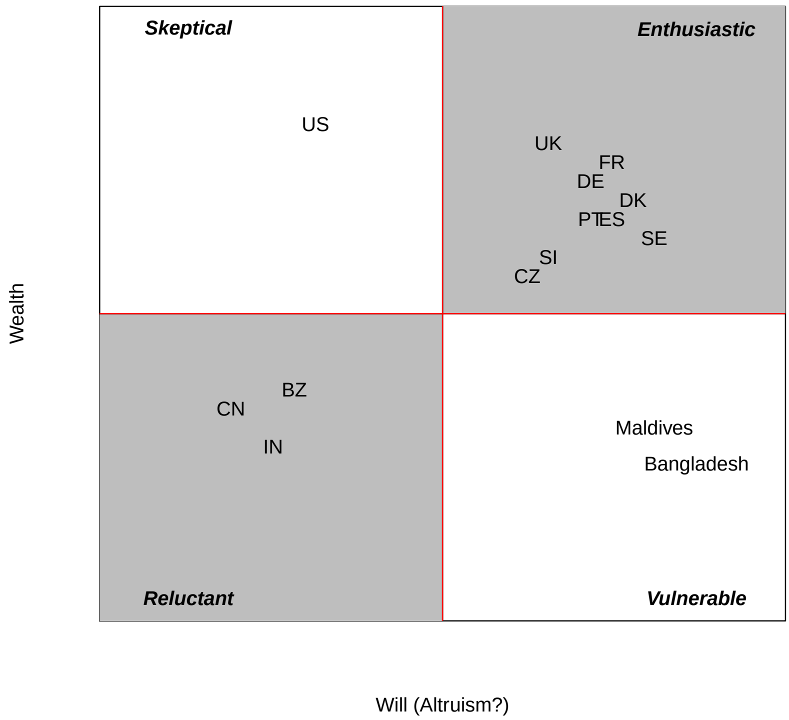


Figure 3.1: The conventional model of climate action, supposing that the choice to act is driven by a combination of altruism and wealth. "Enthusiasm" and "Reluctance" are based on the analysis by Victor (2011). "Vulnerable" states are those for whom climate change poses massive risks: the Maldives, for instance, is only 0.5m above sea level and is presently seeking new territory in anticipation of rising sea levels.

3.3.2 Beyond wealth and altruism: issue linkage and energy systems transformation

In contrast to these explanations for action and inaction, I posit that countries will institutionalize emissions reductions when the changes required of the energy system generate ancillary benefits elsewhere that can be used to justify the costs of emissions reduction[5]. Those benefits provide the means for two politically important tasks: first, to compensate losers who might otherwise have diluted or blocked progress on emissions reduction; and second, to create new interests allied to emissions reduction because of the acute benefits it brings, rather than a diffuse desire for environmental goods. The energy system thus frames whether and how emissions reduction can generate private as well as public goods; and whether those private goods can help stabilize improve outcomes for both the winners and losers from emissions reduction. Moreover, it can provide observable implications for the behavior of countries unlikely to develop either postmodern political mentalities or vibrant green parties in the near future.

Making enthusiasts of the nations? The promise and shortcomings of issue linkage

Issue linkage has often been proposed as a solution to overcoming the incentives to free-ride at the heart of the emissions problem. As modeled by Tollison and Willett (1979), issue linkage proposes that coupling progress in one domain to progress in another can create new equilibria that improve negotiation outcomes for both parties. This is principally true, as in Sebenius (1983), if the pattern of costs and benefits in the two issue areas are asymmetric among the negotiators. If progress on an issue that principally benefits one party can be coupled to another issue that benefits the other negotiating partner, both may find reasons to accept a resolution to the issue area that they do less

[5] Urpelainen (2009) suggests that a similar dynamic may take place at the sub-national level. He presents a model wherein local politicians act despite national inaction on the basis of superior private information about near-term economic or political benefits. He then suggests that acting reveals information to national politicians, who may then act themselves. This section suggests that those benefits do not scale, and so can only form part of a multifaceted political deal.

well at.

Traditionally, the study of issue linkage has emphasized inter-state relations and the terms under which states would cooperate in an otherwise anarchic world. There, the notion of issue linkage has been studied empirically in joint negotiation of economic and security issues (Davis, 2009), trade liberalization across sectors (Davis, 2004), European integration (Huelshoff, 1994; Moravcsik, 1993; Moravcsik and Nicolaïdis, 1999), European Community policymaking (Weber and Wiesmeth, 1991), and trade sanctions (Lacy and Niou, 2004).

In the international negotiations on climate change, however, issue linkage has not lived up to its success in other policy domains. The Kyoto Protocol contained provisions for two programs, the Clean Development Mechanism (CDM) and Joint Implementation (JI), that were intended to align developed and developing country interests. Traditionally, developing countries had demanded compensation for participation in emissions mitigation. But pure cash compensation was not acceptable to the developed economies. Instead, CDM and JI were intended to provide implicit side-payments from developed to developing countries. For CDM in particular, developed countries would gain emissions reduction credits by investing in low-emissions development projects in the developing world. Since those projects would in general be cheaper than equivalent emissions reduction in the developed world, the rich countries could benefit from cheaper emissions abatement options. Meanwhile, the poor countries would get the capital they wanted, and a high-tech infrastructure base to boot. In practice, however, these assumptions proved unworkable. Neither CDM nor JI delivered very much in the way of emissions reduction, and the development projects proved as vulnerable to corruption, abuse, and various other problems as any other international development effort.(Wara and Victor, 2008; Schneider, 2008)

More recently, the departure of the US from the Kyoto Protocol saw issue linkage in areas such as trade or technology proposed as a means to draw the world's largest emitter back in.(Kemfert, 2004; Buchner et al., 2005). But Hovi and Skodvin (2008) show that these proposals would probably fail and do serious damage to international economic institutions along the way.

Issue linkage through the energy system: assets and credible commitment

These actual and potential failures of issue linkage in climate change policy arguably stemmed from the choice of issue areas and the ensuing lack of reasons to take the linkage seriously. The size and importance of the US economy makes any threat to cut it out of global markets unbelievable. Likewise, the CDM and JI mechanisms depended on the assumption that rich economies counted climate change benefits as real and tangible, and would thus readily trade real cash for poor countries' participation. In practice, the rich countries ran into real limits to both will and wealth.

Instead, I argue that successful issue linkage will emerge from the problems and opportunities created by national energy systems. The complementary nature of the energy system means that changes to reduce emissions will necessarily impact a range of other functions that system performs. As section 3.2 showed, that reality complicates the process of systems transformation. But it also raises the potential to generate real, tangible, and near-term benefits. If states can use energy systems transformation to solve problems created by their legacy energy systems, or to pursue new opportunities, they may find real, credible, and even physical reasons to tie emissions reduction to other energy policy domains. Moreover, because the benefits that underpin these linkages flow from the evolving physical assets and markets that make up the energy system, they should be more credible and thus stable than other attempts at issue linkage in climate policy.

The potential for issue linkage is not confined merely to inter-state relations. Indeed, given the predominately national scope of energy systems, opportunities for issue linkage across states should be somewhat limited. Rather, the theory of issue linkage proposed here suggests that it will primarily involve coupling across interest areas within domestic or regional systems where emissions reduction can be tied to the creation of privatizable economic benefits ancillary to the climate problem itself. But, as we shall see in the European case, this does not discount the possibility that inter-state cooperation on systems transformation can display similar phenomena, particularly where energy system interests correlate strongly with state boundaries.

To support issue linkage, a low-emissions energy systems transformation offers two primary categories of ancillary benefits:[6]

1. Reduced risk to energy supply and price insecurity

   Energy security refers to the degree to which a country's energy system is exposed to either supply disruptions or price shocks and price volatility. Insecurity induces harm in two ways: supply disruptions interfere directly with the functioning of the energy system; and price shocks and volatility can adversely affect the competitiveness of domestic firms and their ability to engage in long-term production planning.

   Supply insecurity results from the origins and diversity of imported energy. Most countries depend in one form or another on imported energy for electricity generation and transportation. Adjacent countries may also engage in cross-border electricity trade. In many cases, those imports come from parts of the world that are geopolitically unstable or unpalatable (the Middle East), or with which the importing country has unstable relations (as with eastern Europe and Russia). This instability has often resulted in supply disruptions, particularly if a country depends on one or a handful of countries for the majority of its energy supplies.

[6]Several forms of benefit, including public health benefits from reduced pollution, are not mentioned here. While there is little doubt that these benefits do exist, they do not provide the kind of acute and tangible improvements necessary to offset the acute and tangible near-term costs from emissions reduction.

In contrast, low-carbon energy is usually domestic energy.[7] The sources of renewable energy are ubiquitous, and can be exploited on domestic territory. As such, they offer (for electricity generation, in particular) the opportunity to reduce domestic dependence on imported fuel sources. To the extent that energy insecurity imposes negative externalities on economies, the improved security of domestically-generated renewable energy provides immediate benefits to domestic firms and citizens. There may also be a prospective justification for such investments, insofar as aggressive competition from emerging economies for preferential access to fossil fuel resources may signal future supply constraints and instability.

Price insecurity originates from a wholly different set of phenomena. Even if countries are unconcerned about potential instability of supply, they still confront impacts of fluctuating world prices for fossil fuel energy. Energy importers are mostly price-takers on world markets. Price fluctuations in domestic energy bills have important consequences for the balance of trade. In a floating currency regime, this translates into fluctuating exchange rates and downstream impacts on the price of domestic goods in export markets. Price fluctuations also impact the cost structure of domestic firms and may interfere with long-term production planning, or impose hedging costs on firms in order to mute the effects of world price volatility.

Reduced fossil fuel consumption can generate price stability benefits in two ways. First, on the assumption that fuel costs will continue to rise over time, it can provide relative improvements to the competitiveness of domestic firms compared

[7] The DESERTEC project under consideration at the European Union is an exception. It anticipates building large solar farms in the Sahara, and linking them into the European power markets through long-distance undersea transmission cables. The cost/benefit profile of the project aside, political instability in north Africa in early 2011 has provided some cause for re-thinking the wisdom of this project as a solution to supply instability.

to more energy-dependent foreign firms.[8] Second, to the extent that volatility itself–and not just the price level–imposes costs, the reduced exposure to price volatility that comes with reduced exposure to fossil fuel markets can generate real cost advantages there as well.[9]

2. Employment, comparative advantage, and energy systems performance

   In contrast to energy security, which improves benefits through reduced risk exposure, low-emissions energy sources may also improve the economic prospects for existing and new sectors of domestic economies. These benefits can arise from technological advantages in new industrial sectors, job creation in protected sectors, or improved functioning of domestic energy systems.

   Renewable energy has the potential to become a significant growth industry based on a wide range of new innovations, technologies, and expertise. There is evidence that this industry benefits substantially from learning-by-doing effects: the knowledge required to successfully design, build, and deploy these assets at scale requires actually designing, building, and testing them in real-world environments.[10]

   Under this set of assumptions, states that start early on energy systems transformation may benefit from spillover effects in the competitiveness of domestic

[8]Interviews with senior policymakers in Denmark in early 2010 suggested that this motivation was well-understood. They viewed their greater energy efficiency as a contributor to increased Danish competitiveness amidst high and volatile fossil fuel prices. This interview evidence provides additional confirmation of the results in Urpelainen (2011). He provides evidence that export-oriented OECD countries with limited access to cheap energy face strong incentives for energy efficiency as a way to reduce input costs and protect comparative advantage.

[9]Wal-Mart is an interesting case in this regard. Given their sheer size, energy became a sizeable cost center that had historically gone un-examined. Cooperation between Wal-Mart and the Nature Conservancy, among others, led to a corporate emphasis on energy efficiency. Wal-Mart subsequently used its buying power to bring down the cost to consumers of various energy efficiency goods. Wal-Mart is of course an outlier on both energy consumption and corporate size, but this case is at least indicative of the myriad challenges and opportunities for energy efficiency improvements. See Gunther (2006).

[10]See, for instance, Heymann (1998) on the parallel development of the Danish, German, and American wind power industries; and Schneider and Azar (2001) on the justification for early investment in emissions reduction based on arguments over knowledge capital accumulation.

industry that produces renewable energy sector goods. The potential, or reality, of such spillovers may be a motivating factor for states to engage in emissions reduction.

The benefits created through these new industries may improve policy sustainability as well as policy acceptability. The new industrial interests created by this process (namely, the renewable energy sector firms, their workers, and their supply chains) will have material reasons to support the continuation of emissions policy and offset the weight of interests that might lobby for moderation or discontinuation of the policy framework.

Improvements to the efficiency of domestic energy systems may also generate new sources of employment in protected sectors. Roland-Holst (2008) has shown that energy efficiency improvements can generate positive employment feedback in sectors protected from international trade. In brief, improvements to energy efficiency reduce demand for employees in the energy sector, but release funds for uses other than energy purchases. Empirically, it appears that most of those funds go to buy output from more labor-intensive sectors than energy, leading to overall employment growth, much of which occurs in sectors insulated from international competition, such as services.

Finally, a low-emissions energy systems transformation may, in certain circumstances, improve the function of domestic energy systems directly. Chapter 3 argued that non-nuclear low-emissions energy sources usually provided inferior energy compared with fossil fuels, necessitating expensive complementary investments in systems stability and creating cost/benefit problems for motivating energy systems transformation. While this argument is highly salient in developed economies, it may not apply to developing economies that under-consume energy services and do not have fully-developed power transmission systems. There, the ability generate power locally, without the need to build large and ex-

> pensive infrastructure, may mean that renewable energy provides new and valuable energy services. Coupled with energy security arguments in the context of rapidly increasing emerging-country demand for fossil fuels, renewable energy may offer tangible near-term benefits from improved energy services that would motivate the adoption of renewable energy over other alternatives. However, to date this appears to have meant adoption of renewable energy as a complement to, rather than substitute for, additional fossil fuel energy capacity.[11]

Thus, consistent with Jacobs (2008), if policies that impose short-term costs via emissions reduction nevertheless create parallel interests in favor of the process of emissions reduction, then they stand a better chance of surviving political constestation. Those interests will need to grow out of the benefits created by a low-emissions energy systems transformation. Potential opportunities include improved energy security, industrial competitiveness, or lower-cost energy in remote areas. The potential for such gains offers the crucial possibility of creating and sustaining a bargain with industrial interests in favor of continued action.[12] Finally, because these benefits are all near-term, tangible, and privatizable, they offer support for climate change action independent of the altruism of voting publics.

The potential for such ancillary benefits now or in the future provides better explanatory power for understanding why countries fall into the "enthusiastic", "reluctant", or "skeptical" categories outlined in figure 3.1. Unlike arguments built on the intersection of wealth and green parties, it provides a better prediction of the geometry of policy action, grounded in the need for long-term policy institutionalization and not just short-term policy action. Stated formally, the potential for ancillary benefits to se-

[11] See here, for instance, Asif and Muneer (2007) on Chinese adoption of renewable energy amidst indigenous reserve constraints; and Karekezi and Kithyoma (2002) on the potential for solar energy to improve rural electrification in Africa.

[12] Urpelainen (2012a) provides a formal model of this process in which excess profits from renewable energy mandates drive support for politicians who supported them. Since more stringent mandates provide larger profits, politicians may have greater incentives to deliver more stringent mandates over time.

cure political coalitions from issue linkage depends, as in Tollison and Willett (1979), on whether expanding the issue domain in the bargaining process brings in issue areas that have varied distributions of costs and benefits. In the case of climate change mitigation, the legacy structure of the energy system plays a powerful role in dictating whether and in what domains these linkages can occur.

Chapter 4 will provide empirical evidence for the role played by issue linkage in policy adoption in the EU. Europe's pursuit of climate change mitigation could occur in large part because its energy system allowed the use of emissions control to generate benefits from improved energy security, larger markets for domestic renewable energy firms, and reduced exposure to international energy price volatility. In contrast, the United States, which imports relatively little energy, has substantial domestic coal and gas resources, and where renewable energy goods industries have much less economic weight, has fewer opportunities to use energy systems transformation to offset the costs of climate change mitigation with near-tern benefits. Finally, China and India, if reluctant to sign on to significant international emissions reduction targets, nevertheless derive significant benefits from renewable energy adoption in the form of better energy security, and improved energy system, and comparative advantage in new industries. To the extent that the opportunities for those benefits persist, we may expect these countries to become more willing to adopt emissions reduction policies directly as they become wealthier.

3.3.3 How: second best solutions and the rise of green industrial policy

The motivation to act, as outlined in section 3.3.2, does not necessarily imply the will to adopt a pre-packaged set of policy solutions. In choosing policy instruments, states face the challenge of using issue linkage to create a coalition in favor of action. Once policy is adopted, however, that challenge shifts to sustaining climate change mitigation over a 50-75 year timeframe. As Patashnik (2008) has pointed out, policies intended to serve general interests face long-term vulnerability even after passage, as the enthusiasm that helped pass them fades while opposition endures.

Consistent with Victor (2011), I argue that states will adopt policies that have the best chance of disguising the costs they impose, and provide the most opportunity for disguising transfers to losers from climate change. As Victor argues that implies that most emissions pricing regime will probably use cap-and-trade schemes instead of taxes to regulate emissions directly. As chapter 4 will show, the process of cap setting and permit allocation integral to a cap-and-trade scheme provides more and more implicit opportunities to structure side-payments among interest groups. Those payments, consistent with issue linkage in other domains, have proven to play important roles in overcoming opposition from otherwise recalcitrant actors.

Policy sustainability, however, will likely require states to adopt a multitude of instruments beyond emissions regulation. Sustaining emissions policy over a 50-75 year duration will require ongoing support for a low-emissions energy systems transformation that will impose large losses on owners of fossil fuel capital and resource assets. Shielding the policy regime from pressure to dilute or reverse it will require going beyond just muting the costs these interests will incur. Rather, policy must create a range of equally acute new interests and beneficiaries in favor of systems transformation.

Creating acute and salient interests in support of systems transformation can occur most easily via narrowly targeted policies that support things like renewable energy adoption, energy efficiency, and power grid reform directly. As section 3.4 will argue, this goes against conventional wisdom on "optimum" climate policy. Whether emissions pricing alone represents the most "efficient" climate policy may be open to debate. But it most definitely makes the costs of emissions reduction obvious to the narrow interests who incur them. Furthermore, as an intentionally hands-off form of emissions control, pricing also implies relatively little influence over the specific trajectory of the energy system, which may lead to emissions reduction that generates few ancillary benefits (by, for instance, replacing domestic coal consumption with imported natural gas at a 50% savings in emissions per unit energy, but a potential increase in price and supply risk). Acute costs, explicit subsidies, and diluted benefits threaten to make pricing, pursued in isolation, politically unstable and prone to reversal. Avoiding these outcomes thus requires moving beyond prescriptions for a one-size-fits-all carbon price.

Structured properly, a low-emissions energy systems transformation may eventually become self-sustaining as it alters the structure of the energy system and the interests of the actors within it. The largest initial losers from emissions reduction will be firms who control significant fossil fuel assets. Since those firms are long-lived utilities, however, the gradual replacement of their fossil fuel assets with non-emitting alternatives may change their preferences over time. Patashnik (2008) provides evidence this occurred under the United States' price-based acid rain emissions control regime. But in that case, alternative technologies were well-known and adoption occurred relatively quickly. In contrast, climate change policy must survive an initial period of technological uncertainty where adoption will occur slowly. Thus stabilizing emissions reduction by changing preferences within the energy system requires policies that can quickly generate interests to sustain it through that initial adjustment period before increasing returns from policy kick in.

The demands of both policy adoption and sustainability thus imply a highly fractured landscape of national emissions policy. The national character of energy systems that grew up in sovereign states with different technical, geological, and economic characteristics now generates very different problems and dilemmas for national economies. This, in turn, implies significant cross-national variation in where and how energy systems transformation may solve these problems and generate the benefits that enable and sustain emissions reduction. What works in a country that imports significant quantities of energy may not matter at all to a country with large domestic coal reserves. Likewise, highly industrialized countries with strong renewable energy goods sectors may view renewable energy investments differently than those without.

3.3.4 Exceptions: exiting from the constraints of systems transformation

Section 3.3.2 argued that state action on emissions reduction becomes more likely when the energy system permits emissions reduction to occur through policies that serve more immediate needs and generate more immediate benefits. Section 3.3.3 suggested that this will move policy away from politically unviable emissions pricing and towards a range of so-called "second-best" options that increasingly look like industrial policy. If true, this would imply fairly binding constraints on the opportunities for action.

Nonetheless, several potential developments could occur that would change this set of constraints. The first, and most obvious, would be a range of technological developments that rendered low-emissions energy very cheap, very reliable, or both. If renewable energy really did become cheaper than fossil fuels, that may change the dynamic of energy systems transformation. In contrast to the argument put forth in section 3.2, it would mean that "green" electrons now had at least one absolute advantage over "brown" electrons. Alternatively, radical and transformative innovation like nuclear fusion could also change the cost / benefit framework of climate action and render the acute cost problem largely null and void.

Barring near-term outcomes like this, we should ask whether emissions policy could attain outcomes similar to those of industrial policy during the postwar era. Then, investment of deferred consumption translated into significantly improved long-term growth prospects in the advanced industrial economies. Policy sustained itself for the better part of twenty years on the grounds that it provided far greater benefits than the costs imposed.

The possibility of such "green growth" gained considerable currency in the aftermath of the 2008-2009 financial crisis and ensuing recession. The linkage between emissions reduction and other environmental goals on the one hand, and re-industrialization and employment on the other, was made explicitly by the U.S. administration, the European Union, the South Korean government, and several American states.(Barbier, 2010) Chapter 7 will discuss the potential for "green growth" in greater detail, particularly with regards to the European Union's stated objectives for leadership in this developing sector. But as Huberty et al. (2011) show, there are grounds for skepticism about the potential for many "green growth" proposals to serve both environmental and economic masters.

Finally, we should remember that earlier energy systems transformations often suffered from status quo bias that obscured potential benefits from the new energy source. Anecdotal evidence from late 16th-century England suggests that wealthy households disdained coal because of its soot and smell and regarded it as absolutely inferior to firewood and charcoal. Only a few decades later, however, well-born women in London are quoted praising the "sweet smell" of coal and mourning the shortage of their now-favored fuel.(Nef, 1932) In the English case, a combination of technological improvements in fireplace and stove design (Allen, 2009), coupled with near-term firewood supply problems in London may have accelerated the acceptance of a new fuel source. While relieving status quo bias will not reduce the technical complexity of the transformation, it appears to have some precedent in relieving some of the distributional problems of transformation via changes in the structure of energy demand.

3.3.5 Consequences for climate action

Returning to the core argument of this chapter, emissions policy-making must occur between, on the one hand, the distributional costs and barriers created by emissions reduction; and, on the other, the technical, economic, and regulatory requirements of a low-emissions energy systems transformation. The political economy of climate change mitigation thus requires a policy framework that can both mediate the distributional conflicts and costs of emissions reduction while accomplishing the multifaceted changes required for systems transformation. And it must do so over a long timeframe, to account for both the pace of change in complex technological systems, and the need for a durable emissions control regime.

Section 3.3.2 has argued that state decisions to act on climate change derive less from the supposed altruism of post-modern citizens than from the extent that the domestic energy system permits policy action to generate near-term benefits through solutions to ancillary problems like security, economic competitiveness, industrial policy, or–in the developing world–energy poverty. But those near-term benefits are not evenly distributed, nor confined to the "enthusiastic" countries. The idiosyncrasy of national energy systems will lead to a varied pattern of costs and benefits from energy systems transformation. This generates a correspondingly varied pattern of actions related to emissions reduction. We should consider what consequences such a theory of political economy would have for comparative patterns of policy choice and action. In principle, we should expect at least three outcomes:

1. Idiosyncrasy of policy adoption

   The degree to which states can access any of the ancillary benefits discussed above varies widely among the major emitters. Countries vary widely in their exposure to trade, their dependence on imported energy, their domestic fossil fuel resources, and their reliance on export income. Thus while energy security and balance-of-payments concerns have motivated Denmark to invest in domestic renewable energy since the 1970s, that argument has not proven very effective to date in motivating United States to do the same. Oil, largely for transportation fuels, constitutes the bulk of US energy imports. Replacing oil with anything other than direct gasoline substitutes would require significant downstream changes to the structure of energy distribution and use. But if those changes must occur anyway, the US could equally well adopt electric vehicles charged with electricity generated by coal-fired plants fueled from the abundant coal reserves of the American Midwest. Furthermore, as a relatively less trade-exposed country than, say, Denmark, the impact of balance of payments improvements from reduced oil imports on national welfare would be relatively modest. Thus the same incentive set doesn't apply, and hence the ancillary and offsetting benefits of emissions reduction experienced in the Danish case aren't good justifications for action in a country like the United States. This doesn't mean that other incentives might not exist–only that the motivations vary significantly by country.

2. Idiosyncrasy of instrument choice

   The idiosyncrasy in the organization of national energy systems, and the implied variation in ancillary motivations for energy systems transformation, suggests different sets of winners and losers across countries. If policy instruments must provide the means to transform the energy system, provide private benefits to new energy actors, and manage the inevitable distributional conflict among the ensuing losers and winners, then we should expect to see variation in the policy instruments chosen by different countries based on the varied interest groups they need to pacify or create.

3. Non-alignment of policy approaches across countries

   The resulting variability of policy choices across countries may conflict with the establishment of a global (or even large regional) policy framework. The UN process on global climate change has proceeded on the basis of a common framework for emissions control, within which nations could adapt internally as they saw fit. But that framework implied the assumption that national policy regimes would somehow be cross-compatible. The Kyoto process, moreover, set up a framework for international carbon emissions trading that assumed, implicitly, a global carbon price. But in practice, policy idiosyncrasy may render this kind of condominium difficult to achieve and sustain in the absence of serious political institutions capable of managing distributional outcomes across states. To date, few political entities exist to do such things.

3.4 Implications for policy adoption

These implications stand opposed to the dominant narrative on climate policy. Policy design recommendations from environmental economics have consistently approached the emissions problem as a negative externality first and foremost. Those who produce greenhouse gas emissions as byproducts of economic activity benefit from the activity, but don't pay for the damages those emissions cause. Without an incentive to minimize emissions, people and firms over-produce them. An optimally efficient response therefore requires a policy that prices the social cost of emissions into the private cost of production.

3.4.1 Policy design: price fundamentalism and its discontents

In practice, this policy proposal has come in the form of a price on emissions, via either a tax on emissions or a system of costly permits to emit.(Pigou and Aslanbeigui, 2001; Baumol, 1972) Theoretically, a price instrument like a tax should produce the same results as a quantity instrument like a cap-and-trade scheme.[13] Both provide incentives for firms and consumers to reduce their emissions so long as the marginal cost of emissions reduction is less than the cost of the emissions tax or permit. The tax or permit system thus provides the incentive for firms and consumers to invest in both energy efficiency goods and lower-carbon energy. Nordhaus (2010) has termed this approach

[13]In practice, Weitzman (1974) has shown that this may not be the case when the social cost is discontinuous, and in the face of imperfect information about the cost of emissions mitigation or the damage from excess emissions. If, for instance, it's clear that the cost of environmental damages go up exponentially when emissions exceed some threshold, then it may be better to use a cap-and-trade system to ensure that threshold isn't exceeded.

"price fundamentalism" and argues that a credible, ubiquitous, and high carbon price, perhaps coupled to an R&D subsidy, should be sufficient to generate the necessary emissions-reducing activity.

Finally, not only must an emissions price exist, but it must become more stringent over time in order to incentivize ongoing emissions reductions. Thus not only must the emissions control regime enter into law, but it must also be updated regularly to push emissions down over time.

3.4.2 Policy reality: implications of energy systems transformation

As Victor (2011) has argued, this policy design is liable to fail on political grounds. An emissions tax or a pristine cap-and-trade system with fully-auctioned permits makes the costs of emissions reduction acute and the subsidies to losers explicit. In doing so, it imposes very large costs on powerful interests while providing few mechanisms to offset those costs, or to develop equally acute and countervailing interests in favor of the policy regime. Thus the policy regime is highly unlikely to pass in the first place, and perpetually vulnerable to erosion or stagnation as attempts are made to raise the price or tighten the cap. Helm et al. (2003) argued that this problem could be solved via the creation of a technocratic body analogous to a central bank, which was institutionally insulated from rent-seeking pressures and which had a narrow mandate to implement the orderly reduction of emissions. But that solution seems highly unlikely. In that political context, it matters little whether emissions pricing does in fact constitute a first-best solution, as the political economy of emissions reduction will rarely if ever permit a solution that satisfies the Nordhaus (2010) criteria of a "credible, ubiquitous, high" carbon price.

Emissions cap-and-trade systems are thought to be more flexible than pure carbon prices. Because the control of permit allocation allows for permit auctions, free or subsidized permit grants, grandfathering, and other kinds of implicit transfers, it can smooth over distributional conflicts that an emissions tax might not. Nevertheless, we should ask whether this more politically viable form of emissions pricing will solve the myriad problems of energy systems transformation discussed above and in chapter 2. There are a range of good reasons to believe that it will not.

First, we should consider whether and why emissions pricing has worked in the past. Supporters of emissions pricing have cited the U.S. experience with acid rain mitigation as a case of radically successful price-based pollution policy. There, a tradeable permits scheme for sulfur and nitrous dioxides rapidly reduced emissions of these acid-rain-causing pollutants after 1990, at a cost nearly forty times less than originally projected.(EPA, 2005) Today, that program covers over three thousand power plants in the United States.

However, as Hanemann (2009) has argued, this past experience bears little resemblance to the problem of greenhouse gas emissions. For acid rain, the technologies required to reduce emissions were already well-developed and their costs and benefits apparent. Moreover, ancillary changes to the energy system–notably the deregulation of the railroads and the mining of low-sulfur coal in Wyoming–permitted rapid and cheap fuel switching that allowed emissions reductions even absent technology adoption. Finally, SO_x and NO_x emissions reduction on the part of power plants made absolutely no difference to the downstream energy system. In this context, the emissions price had only to nudge a fairly small set of emitters to select from a menu of well-known and relatively inexpensive emissions-reducing options. In the context of energy systems transformation, a range of non-price-based changes (discovery and exploitation of new coal sources, reform of the transportation and distribution network) enabled changes to energy production that did not require downstream changes to energy distribution or use.

As we have seen, serious greenhouse gas emissions reduction is quite different. Unlike acid rain emissions, greenhouse gas emissions are inseparable from the process of energy generation. Biomass is a highly imperfect substitute. Thus fuel switching isn't an option in the limit. Many of the technologies or processes required for large-scale emissions reduction or efficiency improvements don't exist. Changes to energy production will, consequence of intermittency and lower density, require downstream changes to (relatively price-insensitive) energy transmission and distribution. Finally, it's apparent that many of the end changes to energy use will require non-price instruments, such as regulatory reform or standards adoption, that were not required for acid rain emissions reduction.

Thus, in summary, emissions pricing (1) does not on its own support the stabilization of institutional frameworks for climate policy as described in section 3.3, and (2) does not solve the myriad problems implicit in energy systems transformation beyond price-sensitive markets: regulatory control of the energy market, monopoly behavior in the power grid, market failures for energy efficiency improvements, and the problem of learning-by-doing and the potential need for early investment.[14] On its own terms, then, emissions pricing as a standalone policy is probably politically unsustainable absent other means to buffer and constrain emissions prices, and may be quite functionally limited. Its claim to satisfy criteria for economic efficiency rests on a set of assumptions about the political economy of climate change and energy transitions that have real limits; and the empirical evidence for prior successes suggests that the emissions pricing would face severe challenges in achieving emissions reduction even if it could be managed politically.

[14]For a review of the innovation issues, see Zysman and Huberty (2010) and its companion articles on research choices for emissions reduction. For a summary of the debate on price-induced innovation, see Popp (2010); Popp et al. (2009). Acemoglu et al. (2009) provide evidence that regulatory incentives alone can induce innovation in a simple two-good model where firms choose between some generic innovation and an emissions-reducing innovation; but the industry (automobiles) and the data (patents) both have limited relevance to the core energy system and learning-by-doing forms of innovation.

3.5 Conclusions

This chapter has argued that the political economy of climate change will lead to a policy suite that looks unlike either the first-best recommendations of economics or the satisficing proposals of the environmental movement. Either of those options requires that states choose virtue–either directly, or by pricing ourselves into it. But the terms of that choice confront serious problems of political economy that inform against believing that virtue will be embraced or preserved.

Rather, sustained emissions reduction will be most likely to occur when its costs and long-term time horizons can be balanced by forms of energy systems transformation that tie in other, more immediate policy goals that generate near-term and tangible economic benefits. The interests created by that kind of policy framework will help provide a bulwark against the opposition that emissions reduction stands to create among losers from climate change mitigation. That, in turn, will assist the institutionalization of climate change policy that will be required to sustain emissions reduction over a long time horizon.

This is not, of course, the first argument to use issue linkage to explain potential or actual choices for climate change mitigation. But in placing the energy system in the center of the climate policy problem, it helps explain both the relative failure of those earlier proposals and the potential for future success. Issue linkage within the structure of the energy system need not assume any particularly innate desire for emissions reduction as a vital outcome, nor does it require that states link costs and benefits across disparate policy domains. Rather, a low-emissions energy systems transformation may permit issue linkage between climate change and other energy-related issue areas because those policy domains are already tied together through the physical, economic, and regulatory structure of the energy system. That connection can help explain why both Denmark and China, for instance, have aggressively pursued low-emissions energy despite radically different positions on economic growth, wealth, and global climate action.

The next chapter turns to empirical evidence for this theory. The European Union operates the world's only comprehensive greenhouse gas abatement program. But alongside the Emissions Trading Scheme, it has also deployed a range of policies on energy efficiency, energy market integration, renewable energy adoption, and research and development. Aspects of this policy suite has been criticized for imposing a range of distortions on the European energy market. But, as chapter 4 will show, that criticism must be balanced against the evidence that the policy suite exploits the kinds of issue linkages theorized here, in order to sustain and institutionalize policy momentum amidst diverse and sometimes fractious interests on climate and energy policy.

4 Europe's low-carbon systems transformation: diverging interests and converging policy

4.1 Introduction

This chapter argues that the form and function of EU climate and energy policy reflects a concerted attempt to link emissions reduction actions to near-term improvements in European energy security, exposure to energy price volatility, and competitiveness in emerging high-technology industries. Chapter 4 showed that the EU is one of a range of countries have adopted emissions reduction measures despite the potential cost and the lack of a binding global emissions deal. But the European Union stands out for its ambitious and comprehensive climate and policy suite. Since 1996, the European Union has initiated the liberalization and integration of national gas and electricity systems, mandated the breakup of state gas and electricity monopolies, put a price on greenhouse gas emissions from electricity generation, established binding targets for renewable energy adoption, and sponsored the creation of EU-level regulatory bodies for trans-European energy infrastructure and markets. Most recently, the Europe 2020 program has established statutory targets for the integration, liberalization, and decarbonization of the European electricity supply system; and ambitious but aspirational targets in energy efficiency. This has all occurred despite an EU enlargement that made internal energy interests more diverse and more dependent on fossil fuels; and despite the withdrawal of the United States from the Kyoto Protocol and the subsequent paralysis in global climate negotiations.

The EU's ongoing activity on emissions reduction points directly to the questions posed theoretically in chapter 4: why would the EU impose the cost of emissions reduction on itself absent a binding global deal; why would it continue to act long after its largest trading partner, the United States, succumbed to incentives to free-ride; and how has the EU maintained momentum in climate policy despite the addition of twelve new member states whose economies are more dependent on larger quantities of dirtier fuels than their western European counterparts? In principle, the free rider problem should have dissuaded the EU from acting absent a binding global deal, and the divergence in EU energy interests that came with enlargement should have made emissions policymaking more difficult. Yet the EU has persisted in its emissions goals, and the new member states did not fundamentally alter any of the priorities ultimately embodied in the 2008 climate and energy reform package. The EU thus presents a particularly acute form of the two questions posed in Chapter 4: *why* would the EU act unilaterally on emissions reduction; and is there a logic to *how* it acted that goes beyond economic rent seeking?

I argue that EU policy reflects the interaction of national and regional energy systems with the demands of a low-emissions energy systems transformation. The characteristics of European energy systems allow this interaction to create overlapping but asymmetric benefits from renewable energy adoption, energy security, and technological innovation. This is particularly true when comparing the outcomes for eastern versus western European member states. Because of how the energy system structured this pattern of costs and benefits, it permitted the EU to tie action on emissions reduction to other outcomes in the energy system that compensated recalcitrant member states and sectors, and incentivized more aggressive action among the more willing countries. The resulting EU policy suite, which mixes emissions pricing with renewable energy mandates, regulatory reform, market integration, and R&D support, thus closely conforms to the predictions of the theory presented in chapter 4.

This argument suggests the limitations of a range of alternative explanations for EU policy action. These explanations cite the postmaterialist turn of European electorates, the role of green parties in pushing climate action, and the EU's search for a foreign policy role after the Lisbon Treaty as important factors in the EU's choice to act unilaterally on climate change mitigation. But these explanations offer little traction on why policy action continued after the addition of new member states whose citizens were much more reluctant to take on the costs of climate change mitigation, and whose party systems had weak or nonexistent green parties. Furthermore, climate policy action has continued despite party alternation in western Europe, and despite the EU's failed attempts at global leadership in important venues like the COP-15 climate talks. These developments suggest that the influence of citizen opinions, party structures, and international politics may be real, but is limited in time and space. Broader explanations for the persistence of EU activity or the specific form that activity has taken need to look elsewhere.

The chapter proceeds in five parts. Section 5.5 provides an overview of the EU climate and energy policy suite and the national context in which it exists. Section 4.3 then discusses prevailing arguments for EU policy action and their shortcomings. Section 4.4 then considers the problem of low-emissions energy systems transformation in the EU context and the specific tasks required to bring significant amounts of low-emissions energy into the system. The choice of policy instruments and their consequences is considered in section 4.5, which shows that the distributional consequences of these changes bind together member states based on asymmetric patterns of costs and benefits created by the nature of national energy systems. Finally, section 4.7 argues that the underlying distributional logic of the EU policy suite should counter critics who see the EU's policy suite primarily as an inefficient and distortionary alternative to a well-designed emissions pricing regime. Instead, the EU's choice of how to implement emissions reduction is closely tied to the question of why it would do so in the face of large incentives to the contrary. If emissions policy must survive fickle citizens, powerful opposition, and economic volatility in pursuit of substantial emissions reductions, then the politics of why countries persist in acting will prove inseparable from how they choose to act.

4.2 Climate and energy policy in the EU

As of 2010, the European energy policy suite consists of four major initiatives:

1. The Emissions Trading Scheme, which sets a price on energy-derived carbon emissions for approximately 40% of the European economy via annual limits on emissions and a secondary market for emissions permits within that limit.

2. The Renewable Energy Directive, which puts binding targets on member states to consume, as an EU average, 20% of their electricity from renewable sources by 2020.[1]

3. The Energy Market liberalization program, which mandates the breakup of vertically integrated national energy markets into separate domains of production, distribution, and retail; and which sets new terms for market competition in wholesale and retail energy provision.

4. The SET-Plan and Framework Programmes, which provide significant EU and member state funding for research, development, and deployment of new energy infrastructure and technologies.

[1] A 20% improvement in energy efficiency accompanies this goal, but as of 2011 has no legal force behind it.

The EU energy policy suite thus provides an array of policy instruments that target emissions reduction, renewable energy adoption, technological innovation, regulatory reform, and market integration. Consistent with chapter 3, these instruments perform an array of tasks required to remake Europe's existing energy system. In brief, the policies together function to:

- Open vertically-integrated markets to price competition
- Equalize terms of access to the energy system for new entrants, notably renewable energy generators
- Enable state intervention in energy markets to incentivize renewable energy adoption
- Plan and fund cross-border electricity transmission infrastructure and market integration
- Provide financial incentives (the ETS) and impose binding targets (the renewable energy mandates) for energy systems decarbonization
- Fund R&D for the next generation of technologies required for energy systems transformation

Figure 4.12 shows that this policy suite did not arrive at once–rather, it evolved over time. Versions of each policy instrument had emerged independently starting in the mid-1990s. The synthesis of these different domains into the 2008 climate and energy package represented an evolution of parallel EU energy and climate policy institutions, with complementary consequences for energy, emissions, and economic redistribution.

An array of other changes occurred in this same period, however. Two stand out for particular importance in the context of EU climate policymaking. First, the United States withdrew from the Kyoto Protocol for global emissions reduction in 2001. The US had played a critical role in negotiating the protocol and in mandating the use of tradeable emissions permits as the central pillar of emissions control. But President Bill Clinton had never submitted the treaty to the United States Senate for ratification (where it faced almost certain rejection), and President George W. Bush formally withdrew the United States from the Protocol shortly after taking office. The withdrawal of the United States marked the departure of the EU's largest trading partner and strongest competitor among the advanced industrial economies.

Second, the European Union went through two major waves of eastward enlargement to incorporate the former Warsaw Treaty Organization states into the European polity. In 2004, ten states–the Visegrad states of central Europe, the Baltic states on the edge of the former Soviet Union, and Slovenia, Malta, and Cyprus–joined the Union. They were followed by Romania and Bulgaria in 2007. These additions to the EU marked a significant divergence in energy and emissions interests among the EU members. As figure 4.3 shows, each of these enlargements brought in new member states with more energy-intensive economies that produced higher emissions and relied more on fossil fuels. While the collapse and renovation of their Soviet-era economies had reduced greenhouse gas emissions from the new member states 24% between 1990-2007, those emissions had risen 5.5% after 2000 consequence of economic growth and re-industrialization. Meanwhile, as figure 4.1 shows, emissions in the original EU-15 were essentially flat from 2000-2007. And as figure 4.2 shows, the new member states remained more energy- and emissions-intensive than the EU-15 as late as 2005.

These two developments posed major challenges to the EU in the context of the cost of emissions reduction. Internationally, the withdrawal of the US would mean that the EU would bear more acutely the cost of adjustment, while its major competitors would not. Internally, the changing structure of member state energy demand meant that newer, poorer member states who relied more on fossil fuels would now have a strong voting presence in the EU institutions.

4.3 Postmodernist citizens, green parties, and international leadership

Scholars have pursued three explanations for the EU's aggressive pursuit of climate change mitigation in spite of these challenges and the free rider problem more generally. First, they credit a rising "postmaterialism" in EU electorates with a greater willingness to exchange income for non-material goods like climate protection. Second, they cite the increased visibility of green parties in government as providing an outlet for these voter preferences. And finally, they note that the EU itself had sought a high-profile foreign policy role for Brussels after the passage of the Lisbon Treaty, and thought that strong action at home would increase its influence and leverage at international negotiations abroad. But each of these explanations, while they offer some motivation for EU action, encounter difficulties when faced with the developments described above. They also provide very little insight into why the EU chose the policy instruments it did, rather than some other (potentially more efficient) policy framework. Given volatile public opinion, a changing mix of member state interests, and an increasingly unfavorable international environment, we need to look beyond public opinion and bureaucratic entrepreneurship in answering why the EU chose to act and what led it to adopt the specific policies it did.

Whether environmental concerns are the product of the increased prosperity of citizens in liberal polities has attracted significant attention both for climate change and beyond. Kitschelt (1994) argued that high material living standards had weakened the old left-right division of European politics. Diekmann and Franzen (1999) find, contra Dunlap and York (2008), that prioritization of environmental concerns correlates with per-capita wealth. Bättig and Bernauer (2009) posit that democracies are, net of income, more likely to express preferences for environmental goods than in other regime types. In this analysis, climate change and other environmental issues are a form of luxury good, available predominately to citizens in wealthy, liberal countries where all their material needs are satisfied. Building on this analysis, Gerhards and Lengfeld (2008) find that support for EU climate and energy policy is stronger among the richer member states.

This changing pattern of public preference for environmental goods permitted, and was supported by, the rise of green parties. From a start as fringe opposition parties in the 1970s, green parties had by 2000 become much more mainstream, and offered real electoral alternatives to longer-established parties of the right and left.(Bomberg, 2002) This included holding power in a coalition government in Germany with the SPD from 1998-2002, and, according to Jacobsson and Lauber (2006), acting as one of the primary contributors to a fundamental transformation in German renewable energy policies in the 1990s.

Finally, Schreurs and Tiberghien (2007) argue that these domestic developments dovetailed with Brussels' search for a new foreign policy role. The Lisbon Treaty, ratified in 2007, formally gave the European Union greater say in making all-European foreign policy. This left Brussels looking for a significant role to play in global politics. Climate leadership fit the bill. Brussels could build on the actions of more aggressive countries like Germany or Denmark to position the EU as a paradigmatic example of a rich, competitive economy willing to bear the cost of emissions reduction and provide global leadership for others to do the same. In doing so, the European Union could define a foreign policy identity separate from the individual member states and assert its newly-won powers in a prominent global venue.

In practice, each of these explanations for why the EU would act in spite of diverging domestic interests and an increasingly frustrating international environment encounter limits when faced with two related developments. First, measures of postmaterialist value alignment are fairly volatile across space and time. The new member states, who now constitute 12 of 27 voting members of the EU, consistently poll as more focused on economic growth and less enthusiastic about environmental action. Attitudes towards climate change also respond to unrelated events like weather and economic conditions.(Egan and Mullin, 2011)

Volatility at the citizen level is matched by volatility at the party level. Climate policy progress has continued in both western Europe and at the EU despite fluctuations in green party popularity at the ballot box. The new Conservative government in the United Kingdom has maintained its commitment to emissions and energy policy despite unprecedented austerity measures in the wake of the 2008-2009 financial crisis. The center-right Danish government's 2011 energy and climate package was so aggressive on emissions reduction that it surpassed even what the opposition party had planned for its own election manifesto.(Danish Ministry of Climate and Energy, 2011) Furthermore, green party preferences for climate action at the EU level cannot explain the choice of policy instruments. The European Green Alliance's Green New Deal would have implemented a less market-based, more comprehensive program of emissions reduction and environmental sustainability.(Schepelmann et al., 2009; European Greens Party, 2009) But as of 2011, interviews with the European Commission and the Parliament provided little evidence that this agenda had attracted significant support in the mainstream European parties.

At the international level, the EU appears to have maintained emissions policy momentum despite its failure of leadership at the COP-15 talks in December 2009. The ongoing inability to use EU policy ambitions to catalyze a global deal does not seem to have made a material difference to the long-term trajectory of European climate policy.

To date, then, analysis of EU climate and energy policy has tended to emphasize public opinion, party politics, and bureaucratic entrepreneurship at the international level. But while these factors undoubtedly influence the will to act, they have limited insight as to why the EU has persisted in its climate goals even as those factors have changed in quite substantial ways due to EU enlargement, electoral politics, and political stasis at the international level. Furthermore, they do not explain why the EU picked the constellation of policies that it did. Indeed, given the near-unanimous conclusion that emissions pricing alone should suffice for the most cost-effective solution to climate emissions, we should wonder why we observe the potentially rather more expensive mix of pricing, mandates, subsidies, and other policy instruments that we do.

4.4 An energy systems transformation: the whys and wherefores of EU policy choice

A full understanding of how and why the EU was able to make progress on emissions needs to start with a closer understanding of the comparative pattern of energy and emissions intensity in the EU, and with the structure of the markets and infrastructure at the root of that pattern. The costs and benefits, and hence winners and losers, of emissions reductions are inseparable from the energy system through which those reductions must occur. The dilemma for climate policy, as posed in chapter 3, is whether and how the changes to that system required to lower emissions can also serve other energy-related interests that deliver near-term benefits for action. If so, the system may open the possibility of sustaining emissions reduction via yoking progress on systems transformation to other, more tangible and near-term interests.

This section shows that the EU's pre-existing energy system provided an array of challenges and opportunities for EU energy policy. In the south and east, "energy islands" exposed some member states to supply insecurity even as their neighbors enjoyed surpluses. In the north and west, formerly abundant reserves of oil and natural gas in the North Sea began a decline that would have significant long-term impacts on energy exports and national trade balances. Except in Scandinavia, regional gas and electricity market integration remained a halting task, and national boundaries and energy markets persisted in the face of early efforts at market reform. Meanwhile, some countries had developed significant expertise in and export income from new renewable energy technologies. As section 4.5 will show, these varied patterns of energy markets and the interests that went with them created opportunities to engage in a systems transformation that served multiple masters. In doing so, it could provide implicit side-payments to different constituencies that permitted the EU to bridge the potentially divergent interests in fossil fuel-based energy. The system thus facilitated issue linkage in a particular fashion, leading to a particular policy suite as a result.

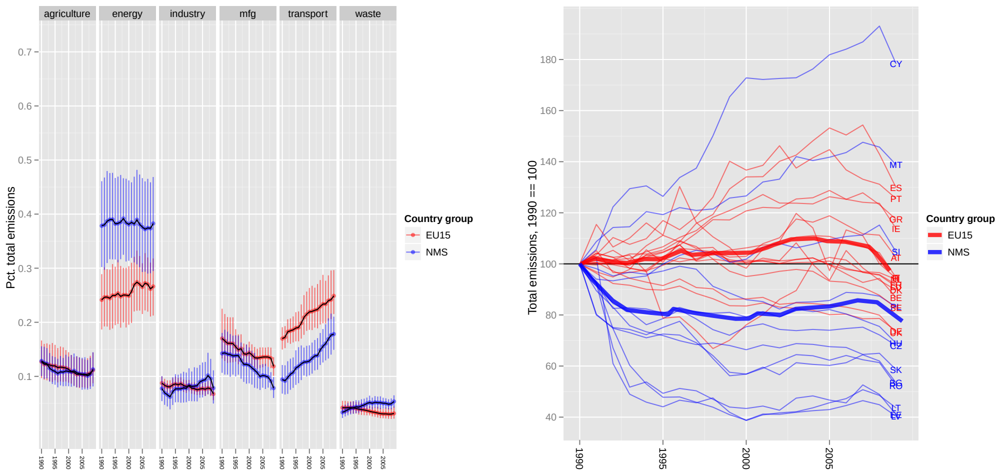
4.4.1 Emissions

As a collection of diverse regions and economies, the EU member states show significant variation in both the intensity of emissions and the trajectory for emissions growth and reduction. In 2007, overall greenhouse gas emissions levels in the EU-27 stood 9.3% below 1990 levels.[2] That aggregate figure obscures some internal diversity. Among the EU-15, emissions fell 3% in the same period, while among the member states added after 2004, emissions fell 24%. But while emissions in the EU-15 were more or less flat from 2000-2007, emission in the new member states grew 5.5% as their economies re-industrialized. Figure 4.3 demonstrates that net of these changes, the economies of the new member states remain anywhere from 2-4 times more emissions- and energy-intensive than their EU-15 counterparts. This is due in part to a greater reliance on manufacturing compared with services; in part due to increased reliance on fossil fuels in some states, particularly Poland; and in part due to the persistence of inefficient Soviet-era capital stock.

Within these broad trends, the composition of emissions has also changed substantially. Figure 4.1 shows that emissions from manufacturing industries have generally declined in all regions, while transportation has become a larger share of overall emis-

[2] All calculations are based on data released by Eurostat for total and sectoral emissions in the EU member states. 2007 will be used as the latest year for comparison because the 2008-2009 financial crisis and ensuing recession has pushed emissions below trend due to depressed economic activity.

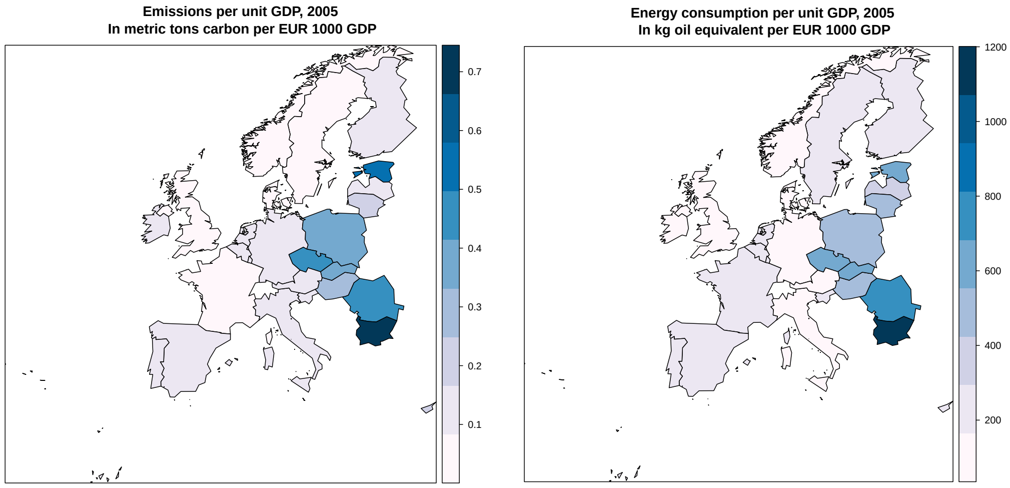
sions. Other categories remained mostly flat. But the manufacturing trend in particular obscures the fact that this trend in the west is in large part due to de-industrialization and a parallel shift to an increased role for services, while in the new member states it reflects the decline (and partial replacement) of energy-inefficient industrial base. Despite these gains, however, figure 4.1 also suggests that the new member states are significantly less emissions-efficient in electricity and heat production than the EU-15.



(a) Changes in emissions composition by sector, 1990-2009.

(b) Emissions levels by country, 1990 = 100. Dark lines indicated within-group averages.

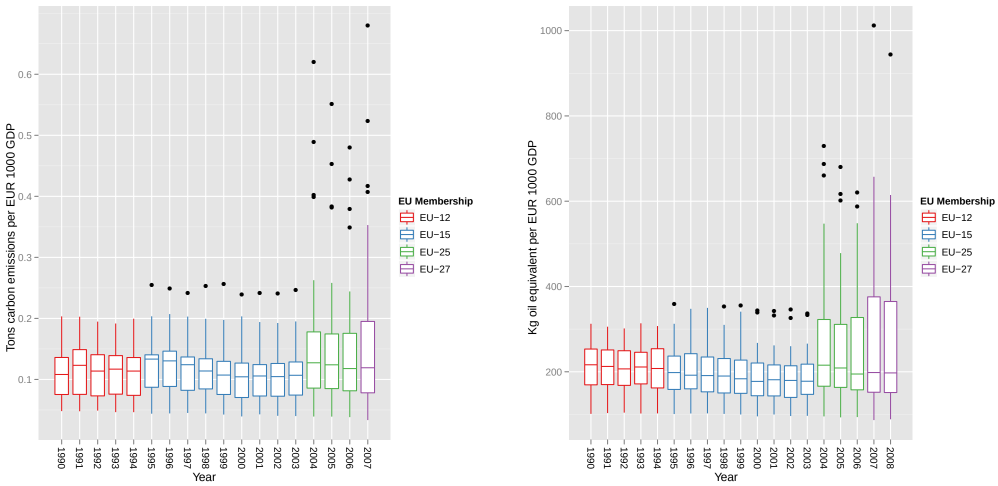
Figure 4.1: EU-27 emissions trajectory, 1990-2009. All data from Eurostat. NMS = New Member States, including the ten new member states added in the 2004 enlargement, and Bulgaria and Romania.



(a) Emissions intensity per unit GDP

(b) Energy intensity per unit GDP

Figure 4.2: Emissions and energy intensity in the EU-27 + Norway, 2005. Greece omitted due to lack of data. Energy intensity data from Eurostat. Emissions intensity data based on author's own calculations using GDP data from Eurostat and emissions data from the Carbon Dioxide Information Analysis Center at Oak Ridge National Lab.



(a) Emissions intensity per unit GDP

(b) Energy intensity per unit GDP

Figure 4.3: Emissions and energy intensity of economic activity in the EU across enlargements. Emissions data are expressed as metric tons carbon per constant €1000 in constant 2000 euros. Energy data are taken from Eurostat and are expressed as kg. oil equivalent per €1000. Emissions data are taken from the Carbon Dioxide Information Analysis center and are expressed in MT Carbon.

4.4.2 Energy

These emissions result, predominately, from the use of fossil fuels to generate electricity and power transportation. How that occurs depends on the structure of the energy systems in the EU–the assets, markets, and regulatory frameworks that govern how energy is produced, distributed, and used. In the context of a low-emissions energy systems transformation, four aspects of the European Union's energy system bear closer examination:

1. The historically national and monopolistic structure of EU energy markets reduced competition among energy firms and limited new firms from entering markets with new technology.

2. The national structure of markets has also led to the existence of "energy islands" with few or no connections to the larger EU energy market. Those islands, in turn, are often highly dependent on geopolitically unstable countries for energy supplies.

3. Decades of significant energy exports from the North Sea oil and gas reserves will probably end in the foreseeable future, with significant impacts for both energy security and national trade balances in northwestern Europe.

4. Adoption of significant quantities of renewable energy in some countries have forced those countries to confront the problems posed by intermittency for both physical and price stability in their energy systems.

Most of the EU member states experience one or more of these issues. But, as section 4.6 will show, variation in the specific patterns of market structure, energy security, and renewable energy adoption consequence of the structure of domestic energy systems has allowed for a particular structure of policies that fulfill both functional and distributive roles in stabilizing the political economy of energy systems transformation.

Market structure

Aside from the highly-integrated Scandinavian Nordpool market, the electricity markets of the European member states as of 2005 remained largely national and dominated by legacy, vertically-integrated state utilities that controlled production, distribution, and transmission. A study for the European Commission's Directorate General for Competition found that five of six major west European markets showed serious evidence of monopoly-driven price and market distortion in 2005, ten years after the first efforts at market liberalization had begun.(London Economics, 2007) As a consequence of market concentration at the national level, markets to manage intermittency and provide for reserve capacity remained anemic.

This situation had three practical consequences for the decarbonization of the energy system. First, vertically-concentrated control of the grid was thought to prevent entry of new technologies into the grid, particularly new low-emissions generation sources. Second, the lack of liquid markets for capacity made management of intermittent energy sources more costly. Finally, anemic competition for electricity customers in the context of regulated prices may have kept prices higher than they otherwise would have been. Pricing power in the presence of impending price increases due to emissions trading posed challenges for managing the costs and benefits of emissions reduction.

Energy islands and energy security

While all EU countries import significant quantities of energy, the structure of imports varies substantially by geography. In particular, the "energy islands" of the Baltic states and eastern Europe depend heavily on imports from Russia to satisfy demand for natural gas and, in some cases, electricity. This dependency led to severe supply disruptions in 2004-2005, 2006-2007, and 2008-2009, as a byproduct of geopolitical conflict between Russia and Ukraine. Notably, during these crises, western Europe maintained gas surpluses that could have been used to offset reduced Russian imports. But the lack of west-to-east transmission infrastructure prevented Europe from implementing this solution in full. The eastern European and Baltic member states remain acutely interested in diversifying their energy supplies.

Thus both northwestern and eastern Europe faced impending risks to energy security, either from decline of domestic resources or geopolitical uncertainties surrounding Russia's relationship with her former satellite states. These risks stand in addition to a general risk stemming from geopolitical uncertainty in Europe's primary sources for transport fuel.

Energy exports and reserve depletion

With several notable exceptions, the EU member states have few conventional domestic energy reserves and depend on imports for the bulk of their energy consumption. Figure 4.4 shows that imports as a percentage of total consumption and by fuel dominate nearly all countries' energy demand. But since the early 1970s, the Nordic countries, the Netherlands, and the United Kingdom have benefited from substantial oil and gas exports from the North Sea. At present, however, the anticipated remaining lifetime of those reserves is estimated on the order of 20-30 years.(British Petroleum, 2011, 43) Danish oil production fell 37% from 2009-2011 alone.(Danish Ministry of Climate and Energy, 2011, 45) Declining reserves pose long-term challenges for these countries' balance of payments and their incomes from natural resource exports.

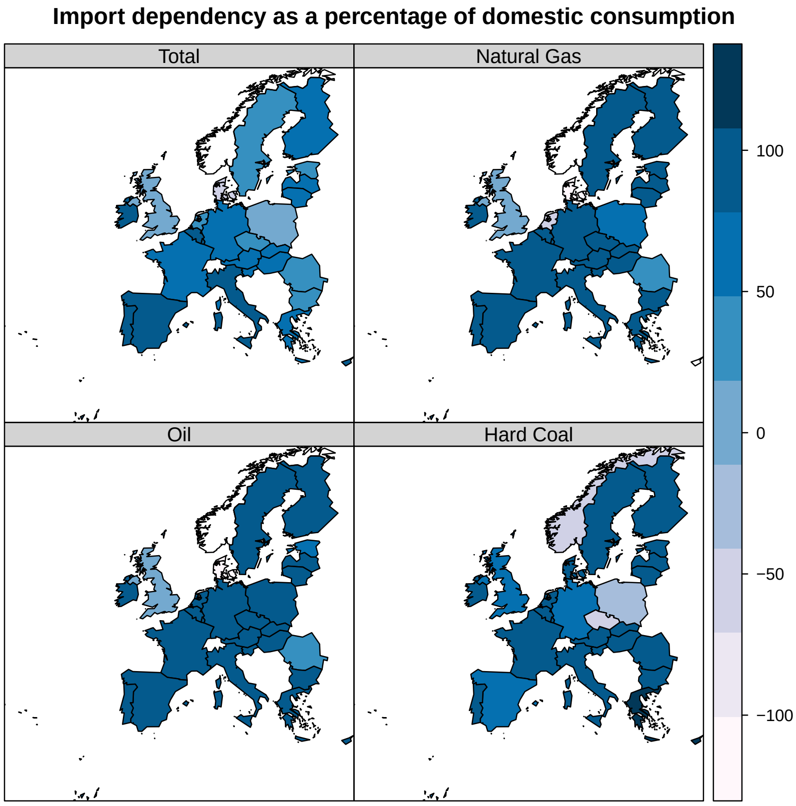


Figure 4.4: Import dependency by fuel for the EU-27 + Norway. Norway omitted for Petroleum, Gas, and Total to omit scaling distortion imposed by Norway's very large gas and oil exports. Data taken from the Energy Information Administration for 2005.

Systems stability and renewable intermittency

Finally, countries that have adopted significant amounts of non-hydro renewable resources have begun to encounter issues with systems instability stemming from renewable resource intermittency. The Nordpool market has been an early test case for this problem. Denmark, which obtains about 20% of its electricity from renewable sources, depends on cross-border trade in the Nordic region to buffer under- and overproduction. In 2010, concerns about overproduction and its effects on systems stability led to the introduction of a €200 / MWh penalty tariff to discourage electricity production at times of overcapacity.(Nord Pool Spot, 2009) As other member states move to adopt significant renewable energy resources, the need for cross-border geographic averaging of electricity production will increase if systems stability is to be maintained.

4.5 Altering the system trajectories: EU Energy Policy, 1995-2010

EU energy policy aims to shift the developmental trajectory of this energy system. Ideally, a new trajectory would reduce emissions, provide greater security of supply, and be more supportive of the international competitiveness of EU firms. To accomplish this shift, the EU has since 1995 deployed an evolving and increasingly synthetic range of policy mechanisms to restructure gas and electricity markets, price greenhouse gas emissions, mandate the adoption of renewable energy, finance cross-border energy transmission infrastructure, and support R&D in new energy technologies.

The management of multiple energy-related externalities complicates the problem of policy formation. But it has also provided EU institutions, member states, and policymakers a means to build sustained policy coalitions through linkage of objectives in one domain to action in others. That linkage generates policy stability in two ways: first, the beneficiaries develop acute interests in ongoing progress that allow emissions reduction policies to move beyond mere cost minimization; and second, linkage provides for cross-subsidization of transition costs among political and economic actors both within the member states and between them. Indeed, whether intentional or not, the policy suite that has developed in Europe over the last decade shows all the signs of fulfilling these political economy functions.

The EU thus displays the kind of policy approach suggested as likely in chapter 3. As predicted there, the EU has not relied solely on emissions pricing to induce emissions reductions. Rather, they have combined an emissions pricing system with other instruments that more directly address other energy-related externalities, and seek to create and nurture interests supportive of systems transformation. In doing so, the EU policy suite has begun to lay the necessary technical and infrastructure foundation for the long-term transformation of the energy system. But this success does not imply that the the EU approach provides a valid solution everywhere. Countries with very different energy systems may not find that issue linkage permits progress in the same fashion, or at all.

4.5.1 Energy market integration and reform, 1996-2010

The liberalization of the energy market began in 1996 as another step in the extension of the Common Market, in parallel with other EU attempts at services and goods market integration.[3] In its initial form, the European Commission justified the program on the basis of more competition in energy markets, lower prices for retail and industrial customers, and improved investment in energy infrastructure.(The European Commission, 2001)

By 2003, the Parliament and the Council had adopted the second gas and electricity directive to begin the process of integrating national markets via interconnection of national networks and reform of wholesale and retail markets for both electricity and gas. Those reforms were to include significant restructuring of domestic electricity companies. Most member states' markets were characterized by vertically-integrated firms that controlled the primary assets for electricity generation, transmission, distribution, and sale. In only three member states (Poland, the UK, and the Nordic countries) did the top 3 firms by turnover control less than 50% of the market.

In 2005, a year after the 2003 directives entered into effect, the Commission reported that progress on market integration had lagged behind directive goals. They noted

[3]This is true with one significant exception: unlike most goods industries, electricity does not permit integration via mutual recognition. Rather, integrated electricity markets require common standards for operation of the electrical grid. The ENTSO-E body has been tasked with this process, but the EU has relatively little experience in standards-based market integration.

that "the most persistent shortcoming is the lack of integration between national markets" owing to national barriers to entry and a lack of cross-border electricity and gas transmission capacity. Of particular concern was the lack of integration of southern European markets, as between France and Spain; the coupling of eastern and western European markets, as between Germany and Poland; and the persistence of the Baltic states as an energy island cut off from the rest of Europe. Energy markets thus remained "national in economic scope", and competition "[had] not yet developed to provide a fully effective constraining influence on the economic power of companies in each national market."(The European Commission, 2005a, 2)

The Directorate-General for Energy also criticized the reluctance of many member states to decouple ownership of electricity transmission and distribution from electricity generation or sale. They viewed the persistent vertical integration of the electricity markets as a hindrance to network neutrality and the entrance of new market participants and new energy technologies. With particular reference to renewable energy technologies (section 4.9), the technical annex to the report (The European Commission, 2005b) argues that both the introduction of low-emissions generation and the pursuit of energy efficiency gains require energy market liberalization. Put in energy systems terms, the ownership structure of electricity transmission was, in the Commission's view, hindering both the restructuring of energy generation and energy use.

The analysis also noted that insufficient liberalization of electricity markets had compounded perceived problems of the European emissions trading scheme, by preventing competition from helping to offset the higher energy prices caused by emissions pricing. Progress on energy market restructuring would, the Commission maintained, introduce competition that would help buffer the costs of emissions pricing for both citizens and industry.

These conclusions were supported by separate studies undertaken by the Directorate-General for Competition, under its Article 17 powers. In two reports, issued in 2006 and 2007, they found persistent high levels of market concentration in five of six major western European electricity markets; ongoing cross-border congestion; and evidence of discrimination by legacy energy utilities against new entrants.(Directorate General for Competition, 2006; London Economics, 2007)

These findings motivated renewed action in the Third Market Directive, passed as part of the 2008 Climate and Energy Package.[4] The terms of the package addressed many of the Commission's 2005 concerns. It renewed the legal framework for energy market restructuring under the newly-signed Lisbon treaty, creating stronger mandates for implementing the earlier guidelines. It set new terms on access to cross-border electricity markets. It also institutionalized EU-level regulatory coordination in three new bodies. The European Network of Transmission System Operators–Electricity and –Gas (ENTSO-E and ENTSO-G) manage regulatory coordination among the national bodies in each member state tasked with operation and regulation of national power grids. They were also tasked with contributing to planning for cross-border transmission infrastructure, with an emphasis on north-south and east-west bottlenecks and the Baltic energy island. Alongside this effort, the Agency for Coordination of Electricity Regulation (ACER) was established to set and maintain regulatory standards at the EU level to ensure smooth grid and market inter-operation. Both the ENTSO and ACER bodies represent substantial institutionalization of previously private- or para-public coordination between otherwise nationally-regulated and nationally-bound energy regulators.

To buttress this regulatory coordination, the EU has followed with support for coordinated approval for and investment in cross-border transmission infrastructure. The TEN-T network infrastructure development program provided a framework for identifying and funding cross-border energy transmission infrastructure in areas suffering from high congestion, or in areas of high renewable energy potential. These included

[4]For text of the directives, see *Official Journal of the European Union* L211, volume 52, 14 August 2009, at `http://eur-lex.europa.eu/JOHtml.do?uri=OJ:L:2009:211:SOM:EN:HTML`.

offshore wind in the North Sea; and cross-border interconnections to the isolated energy "islands" of the Iberian peninsula, the Baltic states, Italy, and the former Warsaw countries.(The European Commission, 2010b, section 4)

4.5.2 The European Emissions Trading Scheme

In contrast to these market reforms, which continue a long pattern of European deepening, the Emissions Trading Scheme (ETS) was a direct response to external events. At the Kyoto talks in 1997, EU member states had committed to emissions reductions of 8% below the 1990 baseline by 2012. The EU believed that it could achieve these reductions more efficiently acting as a body, than if each member state did so on their own. Since 70% of European Union trade takes place among the member states themselves, a pan-EU emissions regulation mechanism would minimize potential distortions to the Common Market that multiple state-level policy regimes could have introduced. It also had the potential to lower compliance costs, by allowing member states to invest in emissions reductions where the marginal cost of reduction was lowest. The Emissions Trading Scheme thus began largely as a carbon market, intended to price carbon and so incentivize emissions reduction via efficiency, investment, and innovation.

The use of market-based instruments for environmental regulation was unfamiliar and highly controversial in Europe. Europe had traditionally favored regulatory mandates, both out of distrust of market-based mechanisms and out of concern that markets would not provide for both equity and efficiency. In examining implementation options in the EU itself, the use of pricing rather than regulatory mandates only became the favored solution after a series of consultations through the first European Climate Change Programme in the period 2000-2001.[5] The outcome of those consultations unambiguously recommended the use of a market-based emissions control system, with emissions permit allocation derogated to individual member states.(Vis, 2001) But the

[5]See `http://ec.europa.eu/clima/policies/eccp/first_en.htm` for further details and documentation.

report also saw emissions trading as one of a suite of policy tools, even if the particular contents of that suite were not foreseen at the time.[6]

These shortcomings in practice had originally motivated the Commission to favor an emissions tax over a cap-and-trade system. But the creation of a European-wide tax would have required either complex harmonization of emissions tax regimes across the member states, or the institution of a new EU-level financial instrument. The Commission had worked for years, without making much headway, to convince the member states of the superiority of a taxation approach. MacKenzie (2007) suggests that the tax finally died in large part because the creation of that instrument would have counted as a financial matter under the terms of the Qualified Majority Voting rules, and thus required a nearly impossible unanimous vote of support. A cap-and-trade system, in contrast, could be justified as environmental policy and passed with qualified majority voting. Doing so also preserved the ability to cross-subsidize participants in the ETS while keeping the visibility of those payments low and depriving the Commission of substantial new financial resources.

After the initial, largely ineffective 2005-2007 “trial period”, the ETS has operated as a system with freely allocated permits that could be banked between trading periods. This has meant that firms do not pay for the initial grant of rights to pollute, but can buy and sell permits on secondary markets. Those permits can be saved across periods, which helps to stabilize permit prices. The overall level of permits is set by the EU, on the basis of national Action Plans from the member states that specify where and how permits should be allocated to their domestic firms. In practice, as section 4.6.1 will show, free allocation functioned as a means of providing cross-payments to vulnerable or reluctant sectors and member states.

[6]Interviews with European climate and energy policy officials in late 2010 confirmed the validity of these official reports and the evolution of concerns about the efficacy and distributional consequences of emissions trading.

4.5.3 Renewable Energy Targets

Theoretically, the presence of the Emissions Trading Scheme should suffice to incentivize adoption of low- or zero-emissions energy sources. Nevertheless, from 2001 onward, the European Union pursued targets for renewable energy adoption as well. The Third Climate and Energy package, passed in 2008, made the initially indicative targets for 2020 and required states to outline their approach to meeting those targets in a series of national action plans. Like the ETS, the renewable energy mandates both support the decarbonization of the European energy system and provide for implicit redistribution of funds between member states. But while the ETS permit allocation process provided for west-to-east transfers, the structure of the renewable energy mandates will, as section 4.6.2 will show, benefit primarily the rich industrial economies of northwest Europe.

The first renewable energy directive (2001)

Renewable energy targets were first introduced as a policy instrument in September 2001 with the Directive on the Promotion of Energy from Renewable Sources.(European Union, 2001) The directive targeted a renewable energy share of EU electricity consumption by 2010, defined what counted as renewable energy for EU purposes, and presented indicative but nonbinding national targets for renewable energy generation. The directive's stated motivations for renewable energy adoption anticipated the trifecta of environment, security, and competitiveness common in later EU climate and energy policy initiatives:

> The promotion of electricity produced from renewable energy sources is a high Community priority . . . for reasons of security and diversification of energy supply, of environmental protection and of social and economic cohesion. . . (European Union, 2001, 33)

The directive marked the culmination of an debate begun in the mid-1990s surrounding the uses of renewable energy and the mechanisms by which to promote renewable sources.(Jordan et al., 2011, 108) The Commission had viewed this debate with some concern. On the one hand, renewable energy promised to deliver energy security and improve economic competitiveness. On the other, the Commission remained concerned that a patchwork of national renewable energy support schemes would distort its attempts at integrating Europe's electricity markets.(The European Commission, 1999) By 2001, the legality of a range of national support schemes had been settled by the European Court of Justice in *PreussenElektra v. Schleswag AG* (European Court of Justice, 2001). This decision confirmed that renewable energy support schemes were valid state subsidies and not illegal state aid, potentially providing member states with new means to justify industrial policy initiatives. Since then, member states have adopted a range of subsidy instruments for renewable electricity generation, including feed-in tariffs, portfolio standards, and secondary markets in "green certificates". Recognizing the growing diversity of support mechanisms and the impracticality of harmonization, the 2001 Directive permitted substantial flexibility in choice of policy instrument.

The question of the harmonization of support schemes has persisted. In developing the first renewable energy Directive, the Commission favored some form of tradeable certificates program that would allow member states to either build capacity domestically or buy it from other member states. In theory, such a program would have increased the efficiency of the renewable energy program by encouraging renewable generation in the most optimal locations, rather than carving up the market along national boundaries. But this program was opposed by the Parliament and the Council.

The second renewable energy directive (2008)

Unsurprisingly, given the absence of binding targets, none of the 2010 goals for renewable electricity generation were met. By 2010, the European Union generated only about

10% of its overall electricity consumption from renewable energy, though generation at the member state level varied from nearly zero to over 60% (for states like Austria with significant hydropower resources).

Despite these shortcomings, the Commission continue to articulate the goals of improved energy security and economic competitiveness, and lower greenhouse gas emissions. In light of the gap between achievements and goals, the Commission introduced a new proposal for binding renewable energy targets in its 2006 energy strategy white paper.(The European Commission, 2006) Those targets eventually became the renewable energy pillar of the Third Climate and Energy Package. In addition to binding targets, reported in table 4.1, the Directive provided for the use of stabilization and solidarity funds to assist new member states in deploying renewable energy infrastructure, and provided narrow definitions of what constituted renewable energy–notably for biomass used in either liquid fuel production or to fire thermal power plants.

Notably, however, the 2008 directive did not resolve outstanding issues of harmonization in either the form or level of renewable policy support. Both the Commission's initial proposal (The European Commission, 2008) and the final directive (European Union, 2009) included this option only in diluted form. Member states could negotiate "statistical transfers" of renewable energy production above and beyond their 2020 quotas, negotiate joint support schemes for renewable energy, or support joint projects to develop renewable energy resources. But no tradeable market in renewable electricity was provided for. The Parliamentary response to the initial Commission proposal (The European Parliament, 2008b) specifically cites member state flexibility and autonomy as the primary concern in maintaining the national structure of renewable energy goals in an increasingly unified European electricity market.

Targets were set as a function of a member state's prior share of renewable energy, its renewable potential, and economic criteria referencing a state's ability to make investments.(The European Commission, 2008, 7) To meet the targets, each member state was required to submit a renewable energy action plan detailing how they would meet their assigned targets. Beurskens and Hekkenber (2011) have formalized the projections made in each national action plan. Figure 4.11 presents their estimates for planned capacity expansions over the 2010-2020 time frame. In aggregate, the member states collectively plan to increase renewable energy use in their economies by over 6% per year. This implies, among other changes, the addition of 146,500 MW of wind capacity and 65,273 MW of solar photovoltaic capacity between 2010 and 2020–increases equivalent to 250% of 2010 capacity for solar and 173% of 2010 capacity for wind.

4.5.4 Origins, evolution, and policy coherence

Energy market reform, renewable energy adoption, and emissions trading thus clearly show significant inter-dependency in their goals, consequences, and costs. As the preceding sections have shown, however, they evolved from somewhat different motivations, both across issue areas and across countries. But while their origins were diverse, they have evolved to be deeply intertwined in their implications for and effects on the European energy system. That fact was recognized in the development and negotiation of the 2008 Climate and Energy package, which synthesized emissions control, market integration, and renewable energy policy into a single undertaking. Interviews with senior EU policymakers indicated that this was done out of a clear understanding of both the functional and distributional inter-dependency between the policy domains. Thus while the different threads of the EU's emissions and energy policy framework evolved separately, they have become more interwoven over time. In both their functional and distributional roles, this should make the policy regime more difficult to dismantle, and more enduring.

4.6 Winners, losers, and compensation in the EU policy suite

By 2008, then, the European Union had synthesized what had been separate initiatives on energy market reform, renewable energy adoption, and emissions control. The 2008 Climate and Energy package was negotiated as a single entity, building on the comprehensive proposal from the European Commission. That proposal, in turn, reflected a policy framework that had over time become more integrated, more stringent, and more enforceable. This pattern, moreover, had continued despite eastern enlargement of the EU.

This section outlines the four primary distributional implications of the EU's climate and energy policy regime. The emissions trading scheme functions as both an emissions cap and a compensation mechanism for three vulnerable groups: poorer east European member states, firms in tradeable sectors, and smaller and less-well-capitalized firms. In contrast, the renewable energy mandates create large new export markets for the relatively rich manufacturing economies of northwest Europe. Finally, energy market reform and integration benefits both systems stability in member states with significant renewable energy shares; and energy security in energy islands and states exposed to geopolitical energy supply instability.

This pattern of costs and benefits, summarized in table 4.2, provides crucial insight into the structure of EU policy choices. Functionally, the suite of policy instruments fulfill an array of technical, market, and regulatory tasks necessary to shift the EU energy system towards a low-emissions trajectory. Distributionally, the particular design of the instruments generates an array of benefits that accrue to member states differently based on the structure of their domestic energy systems. Together, these factors suggest that the EU's success at issue linkage derives from the way in which the structure of the European energy system permitted coupling of the functional requirements of systems transformation to the resolution of distributional conflict over the costs and benefits of energy systems transformation.

4.6.1 Compensation in the ETS: richer, larger, and protected to smaller, poorer, and exposed

Both the design of ETS permit allocation, and the outcomes of allocation, generated three empirical distributional patterns with political consequences. First, the ETS tended to over-allocate permits to the eastern European member states relative to the west. Second, it tended to over-allocate permits to smaller firms and emissions sources compared to large. Third, it over-allocated permits to exposed industrial sectors relative to non-traded sectors, particularly electricity generation. Because the over-allocated permits had cash value on secondary emissions markets, these patterns of over-allocation are equivalent to financial transfers. But those transfers were much more implicit than pure side-payments would have been, which played a critical role in a European Union that lacks real fiscal authority and in which explicit compensation had proven politically unpalatable.

ETS permit allocation for the 2005-2007 and 2008-2012 trading periods occurred as a two-stage process. The European Commission first allocated permits to individual countries on the basis of national estimates of future emissions submitted in National Action Plans. Member states then allocated permits to firms on the basis of the criteria laid out in their National Action Plans. The Commission exercised some veto power over the content of the national action plans, in line with its role in ensuring harmonization in the Common Market.[7] Aggregate permit allocation followed a historical-updating model, wherein permits were allocated based on prior emissions and expected future economic growth, with some correction factor to ensure declining emissions.

But within these aggregates, states had considerable discretion in the assignment of

[7] In practice, the Commission used its veto power extensively. Sixteen of 25 National Action Plans for the 2008-2012 trading period were initially rejected by the Commission for a wide array of infractions. The Commission was particularly concerned that states would use permit allocation as a means of state aid to favored sectors, and policed this kind of distortion of the internal market very carefully. See EurActiv (2007)

permits to firms. Moreover, nearly all permits–upwards of 90%–were freely granted rather than auctioned off. Permit allocation thus allowed for significant distributional discretion on the part of both the Commission (between states) and the member states themselves (between firms). Because the permits themselves had real value on secondary markets, they provided an implicit means of managing distributional conflict from emissions reduction. Over-allocation of permits to a country or sector can be treated as a net asset transfer from under-allocated sectors. Under-allocated sectors either had to either invest more in emissions abatement, or purchase permits on the secondary market. Excess permit allocation to the new member states may have represented up to €1 billion in implicit transfers as of 2007. In particular, figure 4.5 shows that the new member states received a net excess of permits in every sector throughout the first and second trading periods.

Permit allocation also provided a means of compensation to vulnerable sectors in European economies. The first group were the so-called "carbon leakage" sectors, whose exposure to international competition meant that paying for emissions pricing risked their comparative advantage on global markets. The second group were the smaller firms and installations, who had relatively less access to the resources required to adopt low-emissions technologies or operating methods. For the "carbon leakage" sectors, particularly in western Europe, 4.5 shows that the ceramics, pulp and paper, iron and steel, and cement industries all received excess permits in all ETS trading years after 2005. In contrast, the electricity sector–which does not compete directly on global markets, even if electricity users do–began each trading year with a permit deficit. Likewise, figure 4.6 shows that smaller installations received relatively more permits than larger installations. Sometimes the relative over-allocation was 10-100 times actual emissions.

It's important to point out that all these compensation patterns could have existed under an emissions tax as well. Instead of using permit allocation to compensate recalcitrant or exposed groups, tax revenues could have been recycled to the same effect. But that would have required the EU to either obtain the fiscal authority to engage in this kind of redistribution, or to police its member states to ensure that this occurred on a transparent basis that did not distort internal markets for goods or energy. It also would have made the patterns of compensation far more obvious. As the notion of "windfall profits" to specific sectors or firms from over-allocation proved politically controversial in its own right, explicit cash transfers would likely have proven unworkable. Thus it appears, consistent with Victor (2011) and Ellerman et al. (2010), that the choice of a cap and trade system rather than a tax for emissions control fulfilled a particular political logic that tipped the scales between two otherwise theoretically equivalent climate change mitigation instruments.

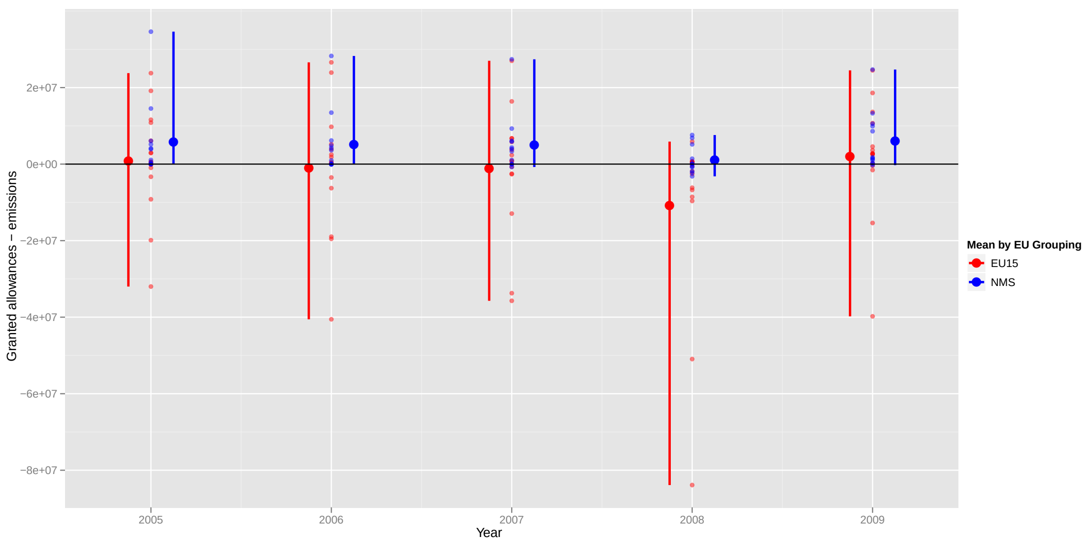


Figure 4.5: Net permit allocation and emissions under the EU ETS. All data from the EU Community Independent Transaction Log (CITL) for 2005-2009 verified emissions.

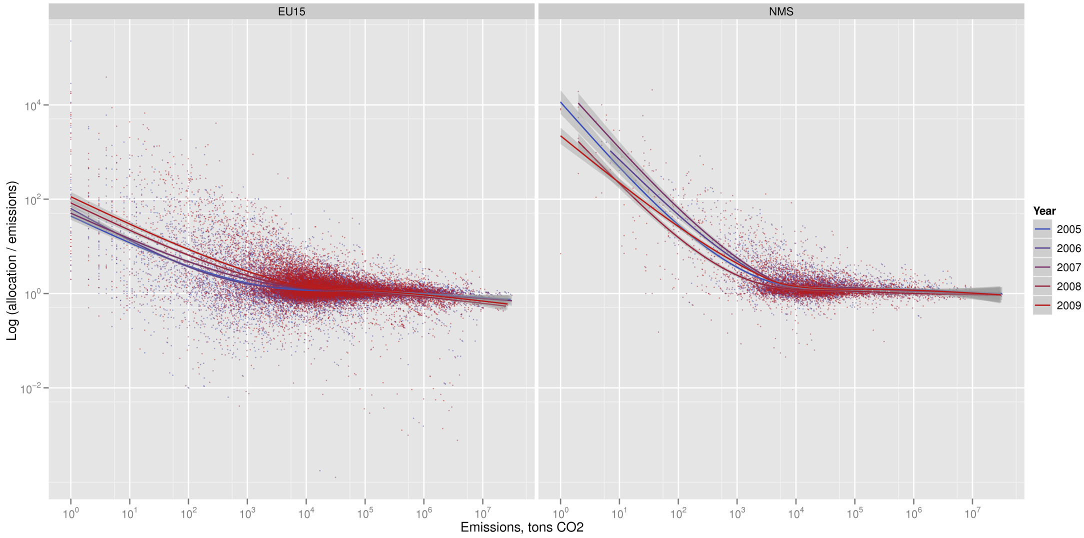


Figure 4.6: Ratio of ETS permit allocation to verified emissions by year and installation, compared with actual emissions at each installation. Each point represents a single emitting installation covered under the ETS. Lines are smoothed annual means via loess regression. All data from the EU Community Independent Transaction Log (CITL) for 2005-2009 verified emissions.

Caveats on over-allocation

These conclusions merit a few caveats. First, it remains very difficult to determine how much excess allocation was due to emissions abatement investments by the countries or firms in question, versus pure over-allocation. That is, firms may have had excess permits to sell because they found investments in energy efficiency or emissions reduction cheaper than the price of permits on the open market. This is particularly true for eastern European firms, whose comparatively less efficient capital stock may have resulted in very cheap emissions abatement opportunities relative to the sale value of the permit. Nevertheless, to the extent that the marginal cost of abatement was still less than the permit price, firms would have generated windfall profits from free permit allocation even if some of the permit revenue went to paying for abatement investments.

Second, there are plausible reasons for permit over-allocation to favor smaller firms. First, smaller installations may have less predictable emissions than very large installations like power plants. Second, it may be reasonable to expect that larger installations had already been optimized for efficiency to achieve operating cost improvements. If that were the case, then smaller firms may have had more leeway to find low-cost emissions reduction options, resulting in excess permits to sell on secondary markets. Nevertheless, it's also the case that very large firms probably have better access to resources to plan and finance efficiency investments than small firms do. Furthermore, and as figure 4.6 shows, many of the smaller installations received on the order of 10-100 times as many permits relative to their emissions, a level of over-allocation that would appear to tip the scales in favor of the subsidization argument.

These caveats aside, the design of the initial phases of ETS allocation provides substantial evidence that countries that faced either higher abatement costs, limited capacity to finance those costs, or loss of competitiveness from emissions pricing were implicitly subsidized through permit allocation. With approximately €30 billion in permits (2 billion or so metric tons at €15 / ton) distributed annually, the implicit amount of funds available for allocation is on par with the annual funding for the Common Agricultural Policy.(Zachmann, 2011) The ETS thus represents both a framework for emissions reduction, and a mechanism to effect transfers that buffer the costs of adjustment.

Implications of future changes to the ETS

The Third Climate and Energy Package, will alter some of these re-distributional patterns. Permit allocation to the member states will continue to occur on the basis of prior emissions. But allocation by member states to firms will, after 2012, occur via auctioning rather than free allocation. This will reduce the value of permits to firms, since the permits will no long represent a net transfer of valuable cash assets.

However, two exceptions to the permit allocation process indicate ongoing distributional behavior inside the ETS. First, the trade-exposed "carbon leakage" sectors, in which energy constitutes a substantial portion of the cost of finished products, continue to receive special treatment for allocation and subsidy in order to protect competitiveness. Second, the new member states also receive some opt-out options for auctioning to their electricity sector. The wording of this section is an excellent demonstration of how the EU climate and energy policy suite allows for implicit rather than explicit compensation. The statute itself says nothing about the new member states in particular. But the specific wording of the section cites criteria on GDP, energy intensity, income, and other factors that implicitly mean that only the new member states will qualify.[8]

Thus the future ETS will have more muted distributional impacts than in the first two trading periods. Ellerman et al. (2010) suggest that the political controversy over "windfall profits" from free allocation, combined with firm dissatisfaction over the unpredictability of allocation levels, led to evolving preferences over time for auctioned rather than granted permits. But free allocation played a vital role in securing the participation of both trade-exposed sectors and the new member states of eastern Europe; and will continue to provide a means of side-payments for the foreseeable future.

4.6.2 Renewable energy targets and export expansion in the rich countries

Patterns of permit allocation provided the EU with a means of managing the costs of emissions reduction. In contrast, the Renewable Energy Directive provides implicit benefits to a set of rich countries whose domestic high-technology manufacturing sectors will supply the bulk of the technologies necessary to meet the 2020 target of a 20% renewable energy share in the electricity mix. Those countries and sectors, in turn, benefited not at all from permit over-allocation. Indeed, they usually operated at a permit deficit and provided the demand (and thus cash) for excess permits from eastern Europe. Prevailing patterns of revealed comparative advantage in renewable energy technologies suggest that this pattern of redistribution will persist for the foreseeable

[8] In practice, it remains unclear how much latitude the Commission will give these states. Interviews with the Commission in early 2011 indicated that the Polish government had applied for and expected a much greater range of latitude in free allocation than the Commission was prepared to grant.

future.

Using the wind industry as an example, we can estimate that the renewable energy mandate will generate as much as $48 billion in implicit benefits to these firms and countries by 2020. Assuming that the planned addition of 146,500 MW of installed wind capacity cited in section 4.5.3 is attained solely through the use of the newest generation of 3 MW wind turbines from leading firms Vestas or Siemens, that's equivalent to approximately 48,000 new turbines. Vestas estimates an installed cost per turbine of approximately $1.7 million, implying a total investment of $83 billion for the turbines alone. Perhaps 60% of that cost is captured by the manufacturing process alone, so that $48 billion of the $83 billion will go to procuring the turbines themselves. This is, of course, probably a conservative estimate: assumptions about future price reductions in wind turbine technology would reduce overall costs. But it provides a near-term estimate of the scale of investment required.

Who benefits from this investment depends on the sources for wind turbine procurement. The highly specific nature of wind turbine design, and the presence of significant learning-by-doing knowledge effects, has led to the dominance of the global wind industry by relatively few firms.[9] Within Europe, the advanced manufacturing economies dominate the market: Vestas in Denmark, Siemens in Germany, and Gamesa in Spain. Figure 7.2 shows that this has resulted in highly skewed patterns of comparative advantage in wind turbines within the EU member states.

Addition of significant amounts of new wind capacity in the European Union will almost certainly result in expanded revenue streams for these firms and their supplier networks.[10] As such, the renewable energy mandates constitute a *de facto* market ex-

[9] Heymann (1998) provides evidence that early Danish leadership over German and American firms in wind turbine design emerged from Denmark's strategy of repeat deployment rather than engineering optimization. Deployment provided information to firms and inventors that could not be replicated in the laboratory. As a result, Danish designs were more successful than their competitors until well into the 1990s, while efforts at very large turbine design in Germany and the United States failed.

[10] This assumes a counter-factual world without binding targets in which those investments did not occur. The failure to achieve non-binding targets in the period 2001-2010 suggests that this is a reasonable assumption. The EU member states would, no doubt, have made some investments in renewable

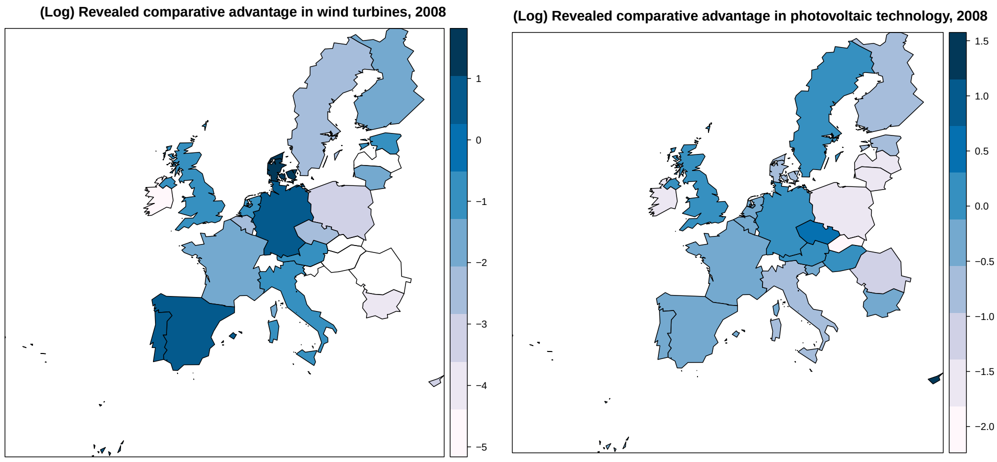


Figure 4.7: Revealed comparative advantage in wind turbine and solar photovoltaic cell exports within Europe. Calculated from the 6-digit UN COMTRADE export data for the period 2000-2010.

pansion for specific industries in specific member states.[11] As figure 4.10 shows, market expansion for wind electricity generation in particular has correlated with export growth for only two countries, Denmark and Germany. Moreover, figure 4.9(a) shows that this market growth is not reciprocal: Denmark and Germany have both maintained substantial positive trade balances in this sector since the mid-1990s.

Moreover, because of the structure of value-add in the wind sector in particular, the secondary effects of an expanded wind industry should be limited. Expanded production of wind turbines will, of course, generate expanded demand for inputs to wind turbine production. Many of these inputs–particularly for a small economy like Denmark–will come from other member states. But estimates of the value-added structure of a wind turbine place approximately 90% of it in the generator and airfoil. Thus most of the value is tied up in the knowledge capital applied to turbine design and construction.

energy goods without the mandates. But the mandates increase the certainty and potentially the size of the investments and imply legally-guaranteed demand expansion in these sectors.

[11] Huberty and Zachmann (2011) provide evidence that renewable energy market expansion in home economies benefits or develops domestic renewable energy sectors only under limited circumstances, and does so preferentially based on pre-existing patterns of competitiveness in related markets.

This will limit the spillover from expanded domestic production.[12]

Solar photovoltaic electricity, the other major contributor to new renewable energy capacity in under the renewable energy targets, has a more broadly distributed pattern of comparative advantage and thus represents a less concentrated transfer. But as figure 4.10 shows, the countries that appear to benefit most from their neighbors' expanding demand for solar electricity are, with the exception of Hungary and the Czech Republic, all western European countries. Moreover, the international solar cell market has changed rapidly, and new entrants like China have rapidly acquired significant market share.(Woody, 2010) Because solar cells are more modular and more easily shipped than wind turbines, this will reduce the degree to which funds for solar energy market expansion stay within the EU. While this may not constitute intra-EU redistribution, neither does it suggest that expanding solar markets at home will lead to improved prospects for domestic solar electricity firms.

Thus the industrial benefits of the growth of renewable energy markets will likely be concentrated in the few countries that are today significant players in wind turbine manufacture. Those countries are themselves mostly highly advanced western European member states, while demand will come from all member states. The renewable energy mandates thus have a significant distributional element to them, on the scale of billions of dollars annually, that runs in the reverse direction from the normal west-to-east pattern common to the EU's cohesion and structural adjustment funds and the ETS.

We may view this linkage process as a kind of technology fund theorized by Urpelainen (2012b). He proposes a fund in which developed countries subsidize low-emissions technology adoption by developing countries, as an implicit subsidy to their own do-

[12]There is one caveat to this conclusion. The newest generation of very large offshore wind turbines cannot be shipped easily due to their size. On-site assembly is therefore required, usually in a port capable of moving the turbines directly to the point of installation. However, while this will capture more value-add for the installing country, it does not fully offset the fact that so much of the sale value is tied up in knowledge capital rather than labor or materials.

mestic clean technology industries. Here, the subsidy of eastern Europe by western Europe combines implicit and explicit measures: explicit, via the solidarity funds; and implicit, via transfers through the ETS permit mechanisms as described in section 4.6.1.

4.6.3 Benefits from market integration and reform: systems security and stability

Finally, the move to integrate national energy markets generates several, highly diverse beneficiary pools. Those countries with high intermittent renewable energy shares–such as Denmark and Germany–are able to average their energy intermittency over a larger market, buffering their own market from energy shortages and selling into foreign markets at times of overproduction. This makes domestic energy systems transformation technically easier and financially less complicated to manage. The first steps in this direction were taken in late 2010, when the Nordic countries and the central-west European regional energy market entered into market-based price coupling, significantly reducing both cross-border price differentials and price volatility on the regional electricity markets.

In parallel, countries exposed to significant external energy supply instability benefit from increased integration with the European market. This last had been a significant problem during the gas crises of 2000-2010, when western Europe often enjoyed gas surpluses while eastern Europe faced shortages. Then, the lack of sufficient cross-border energy market integration forestalled easy solutions and raised the costs of supply disruption considerably. The European TEN-T network integration programs specifically target those bottlenecks for resolution, even as they also facilitate the geographic averaging of renewable energy intermittency and smooth the integration of high levels of renewable energy into existing energy systems.

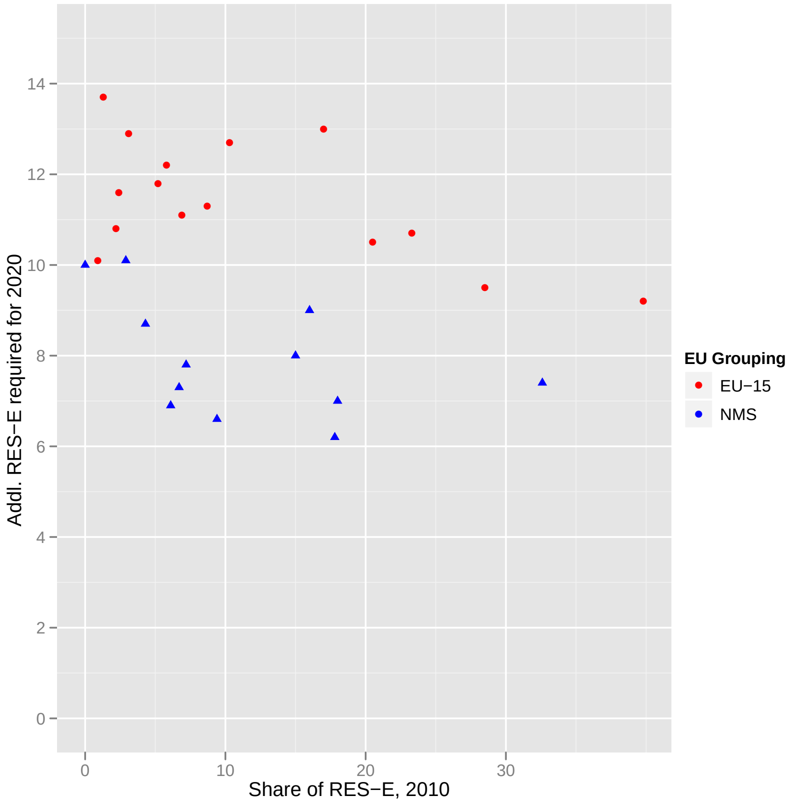
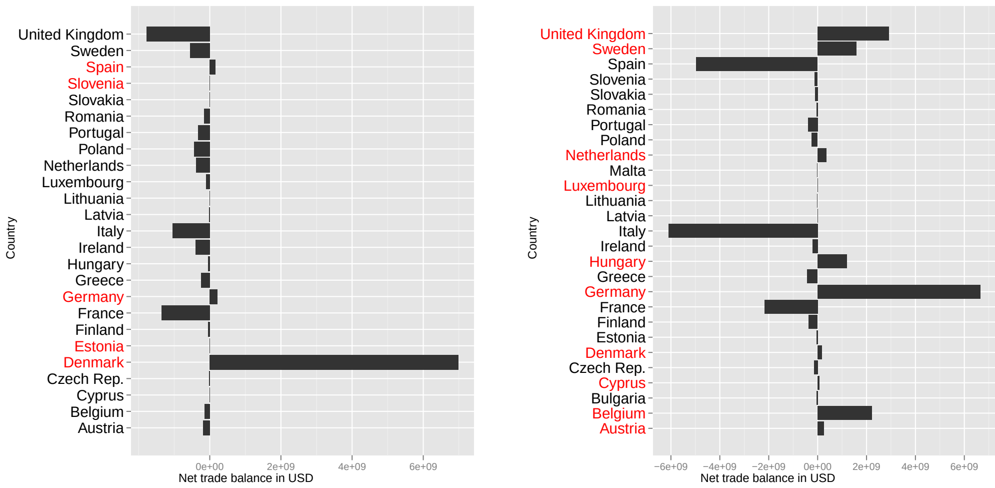
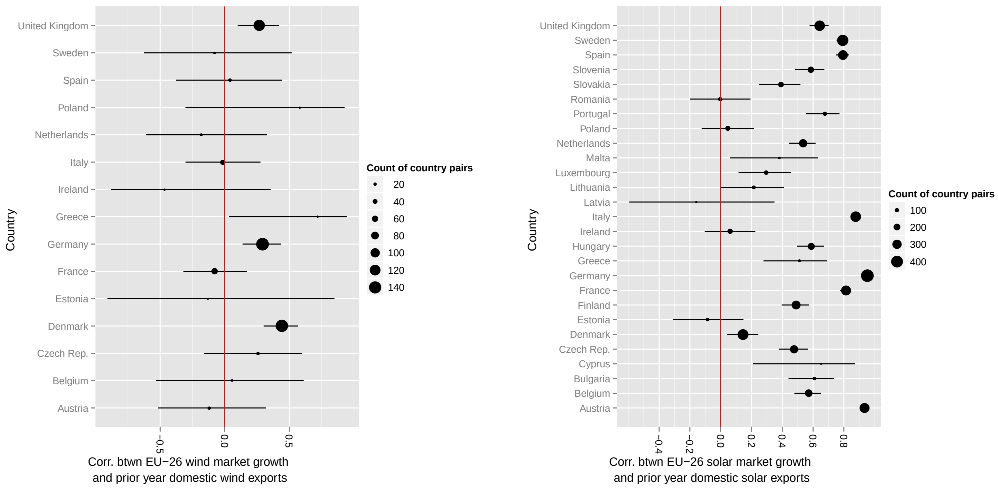


Figure 4.8: Clustering of EU 2020 RES-E targets by 2010 starting points. All numbers shown as the percentage of electricity generation derived from non-nuclear renewable sources. Data taken from Annex 1 of European Union (2009).



(a) Wind turbines (b) Photovoltaics

Figure 4.9: Net trade balance in wind turbines and solar cells, 1996-2009. All data from the bilateral trade figures in the UN COMTRADE database.



(a) Wind turbines (b) Photovoltaics

Figure 4.10: Correlation of prior-year home-country aggregate export growth with EU-26 market growth in renewable electricity generation. Market growth calculated as the year-over-year change in absolute amounts of renewable electricity from wind or solar. Exports calculated as total yearly exports by country for the prior year. Electricity data taken from the Energy Information Administration international accounts. Trade data taken from the UN COMTRADE database. All data from 1996-2009.

Member State	Share of energy from renewable sources in gross final consumption of energy, 2005	Target for share of energy from renewable sources in gross final consumption of energy, 2020
Belgium	2.2%	13%
Bulgaria	9.4%	16%
Czech Republic	6.1%	13%
Denmark	17.0%	30%
Germany	5.8%	18%
Estonia	18.0%	25%
Ireland	3.1%	16%
Greece	6.9%	18%
Spain	8.7%	20%
France	10.3%	23%
Italy	5.2%	17%
Cyprus	2.9%	13%
Latvia	32.6%	40%
Lithuania	15.0%	23%
Luxembourg	0.9%	11%
Hungary	4.3%	13%
Malta	0.0%	10%
Netherlands	2.4%	14%
Austria	23.3%	34%
Poland	7.2%	15%
Portugal	20.5%	31%
Romania	17.8%	24%
Slovenia	16.0%	25%
Slovak Republic	6.7%	14%
Finland	28.5%	38%
Sweden	39.8%	49%
United Kingdom	1.3%	15%

Table 4.1: EU 2020 RES-E targets, as reported in Annex 1 of European Union (2009).

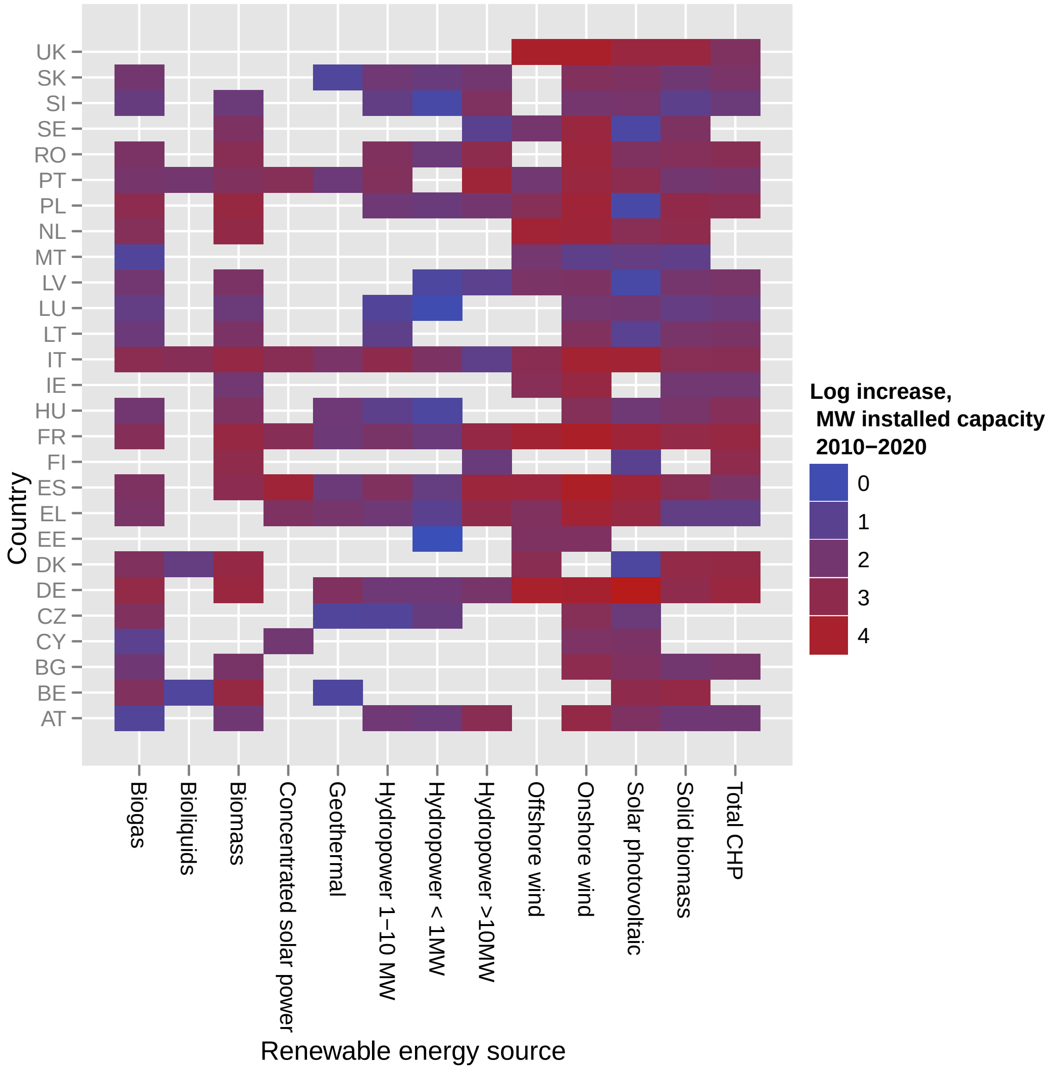


Figure 4.11: Patterns of planned renewable energy adoption in the EU member states, 2010-2020. Source: Beurskens and Hekkenber (2011).

4.7 Against multifaceted policy: emissions pricing and its discontents

This chapter has argued that the EU's success at unilateral climate change action in the face of powerful incentives to the contrary derives from a multi-instrument approach to low-emissions energy systems transformation. In this view, multiple instruments are required to serve the complex tasks required to alter the assets, markets, and regulation that structure the production, distribution, and use of energy. In the case of the EU, the changes required also generated asymmetric patterns of near-term benefits from energy security, export competitiveness, and systems stability that could justify actions that climate change mitigation alone might not have.

Despite the success of the EU policy regime in the face of strong free-riding incentives, diverging energy interests among the member states, and the defection of its major trading partner, the European energy policy suite has encountered criticism, particularly from economists. They argue that the use of multiple instruments, especially technology-specific ones like renewable energy mandates, dilutes the economic efficiency that is the primary motivation for a pure emissions pricing system. As such, it raises the cost of systems transformation and risks generating inefficient or even dysfunctional outcomes for emissions reduction.

This section argues that such an interpretation ignores the importance of the distributional capacity of a multi-instrument approach to balance competing political interests and sustain policy momentum. What appears as rent-seeking distortion should instead be viewed, consistent with chapter 3 as a politically viable and sustainable approach to institutionalizing and improving emissions policy over time. Achieving this kind of outcome in the European Union was facilitated by the use of multiple instruments that addressed near-term challenges in energy security and economic competitiveness as well as long-term emissions reduction goals. An emissions price, deployed in isolation, could not have served these ends, and may have undermined the viability of the emissions regime over the long term.

4.7.1 Redundancy and inefficiency in the EU policy suite

Theoretically, most of the EU policy suite should be superfluous for the EU's climate policy goals. Economic analysis has consistently emphasized the sufficiency of a carbon price–whether through a carbon tax or a permit system–for incentivizing the necessary investments in renewable energy, energy efficiency, or research and development. Nordhaus (2010) has styled this "carbon price fundamentalism" and argues that this approach represents the best long-term strategy for climate change mitigation. In contrast, policies that promote renewables and push energy efficiency may constitute market-distorting industrial policy. For instance, it now appears that most of the 2020 emissions goals in the EU will be satisfied through widespread deployment of renewable energy, even though most cost estimates (such as Enkvist et al. (2007)) show that energy efficiency improvements are often much cheaper per unit emissions.

Most analysis has treated the EU's move to a redundant, multi-instrument climate and energy policy suite as a purely distortionary effect of rent-seeking by powerful industrial and member-state interests. Helm (2009), examining the 20/20/20 targets on emissions, renewable energy, and efficiency, asserts that "the probability that the correct answer. . . of what to do about climate change is even approximately [the 20/20/20 targets] is close to zero", believes that the targets were adopted solely for their signaling value, and concludes that the policies represent a "politically neat but economically inefficient set of targets." Victor (2011, 68-70) explains the EU choice of emissions trading for industrial emissions in terms of rent-seeking on the part of entrenched industrial interests, and the attractiveness of RES-E targets as a similar move on the part of renewable energy interests. Schmalensee and Stavins (2011) and Palmer and Burtraw (2005) argue that renewable energy mandates are a costlier way to achieve emissions reduction than an emissions price alone.

These explanations (and critiques) of the EU energy policy suite point out, correctly, the pitfalls of the EU's approach and the potential for it to raise the overall cost of emissions reduction, and potentially increase the chance of outright policy failure. But the usual prescription for improvements to the policy suite tend to treat these problems as soluble within the narrow framework of emissions policy analysis–usually through the optimization of an emissions price instrument.

This gap between theory and policy implementation is puzzling in light of the political economy of climate change action as outlined in chapter 3. Climate change poses fundamental policy problems because it imposes immediate, acute costs to achieve diffuse benefits far in the future. This structure of costs and benefits has led other major emitters–notably the United States in the developed world, and China and India in the developing–to resist or reject aggressive and coordinated climate action. In the case of the EU, they are powerful arguments for choosing the least-cost means of action. Indeed, interviews with the European Commission in late 2010 corroborated earlier evidence that the EU abandoned earlier ideas for a command-and-control approach to emissions regulation largely because of fears about cost. Despite those concerns, however, they have subsequently added to the carbon price framework a range of policies regarded as more costly, and less efficient, than a carbon price alone.

4.7.2 Complementarity, not redundancy: climate policy as energy policy

In the context of chapter 3, it's not clear that these critiques of the EU's policy suite are justified. As this chapter has argued, the EU's policy suite is attempting to simultaneously optimize across three separate policy domains: emissions, energy, and competitiveness. In doing so, the structure of the EU's energy system has required and permitted the coupling of progress on emissions reduction to progress on other energy-related issues that deliver real, near-term benefits to policy actors. This has both an economic and a political logic. Economically, energy market integration and emissions reduction both required a range of major changes to the EU's energy infrastructure to integrate significant quantities of renewable energy in a stable energy system. Politically, both emissions reduction and energy systems transformation would impose distributional costs on a set of EU energy and emissions interests that had become more fragmented following on the 2004 and 2007 enlargements.

Section 4.6 argued that the policy suite evolved in the face of these issues in the direction of a synthesis that served both the logistical and infrastructure problem, and the distributional problems. It did so via linking progress on emissions reductions to near-term progress on security and the competitiveness of domestic renewable energy firms. The instruments in question provided a range of distributional tools to policymakers that–while no doubt enabling rent-seeking–also kept reluctant energy interests from becoming veto players.[13]

In contrast, optimizing policy for emissions, security, or competitiveness in isolation might have risked fracturing the coalition along these lines. Pursuing emissions reduction through a high emissions price would have two immediate effects: first, it would encourage the substitution of imported gas for domestic coal in electricity generation, at an immediate 40% reduction in carbon per unit energy. Second, it would raise retail electricity prices substantially, and disproportionately in high-carbon-share economies. These developments threatened to create discord among member states concerned about energy security and industrial competitiveness, and among firms in more energy-intensive sectors.

Likewise, pursuit of energy security alone would lead to significantly greater use of domestic EU coal. This is particularly true of the new member states, who lack natural

[13] Carraro (2000) notes that issue linkage had played a role in pre-2000 EU climate policy and attempts at international climate policy leadership. He does not consider the role of the energy system in framing the possibilities for such linkages. Van Asselt et al. (2005) suggest that linkage of climate change to other policy domains could provide a way forward after the 2012 expiration of the Kyoto Protocols, but do not specify the conditions under which that might occur.

gas resources and lag behind in renewable energy technology.[14] Much of the remaining coal in eastern Europe, such as that around Silesia in Poland, is of the soft brown lignite variety (World Energy Council, 2010), which in addition to its carbon emissions carries a much higher share of other pollutants compared to hard coal. Its expanded use would alienate member states more committed to emissions and pollution reduction, and frustrate EU attempts to achieve its commitments under the Kyoto protocols.

In contrast, a renewables target alone would generate significant benefits for member states with strong wind and solar power industries. Those countries would stand to benefit from increased exports of capital goods, such as wind turbines and solar cells, to other member states lacking domestic production capacity.[15] But that would come at large costs to technology-importing countries, both in absolute terms and in the secondary effects on trade balances. It would also do little to solve the various market imperfections that prevent the adoption of net-positive-benefit energy efficiency measures, and would still require significant infrastructure and regulatory changes to achieve a stable, renewable-energy-dominated energy system.

Finally, each of these policy approaches would still have required a mechanism for EU energy market integration. As chapter 2 showed, the introduction of renewable energy generation resources poses stability problems that require significant downstream changes to energy distribution and demand. Making the investments required to maintain systems stability, however, would not have been in the interest of older, vertically-integrated state power monopolies. Their control of both production and transmission of electricity gave them large incentives to favor their own energy production assets in

[14]See, for instance, the Polish response to the 2006 European Commission Green Paper on energy market reform. The Polish government emphasized the need for carbon capture and sequestration, and suggested that most of its domestic investment in more efficient energy technologies would go into more efficient coal energy plants and energy efficiency–not the elimination of coal from its energy supply.(The Government of the Republic of Poland, 2006)

[15]This, of course, is limited to the case in which each member state had binding targets without tradeable certificates. In that case, member states could not satisfy their domestic targets through purchases of excess renewable energy production from abroad. As of 2011, the EU renewable energy goals permit only limited tradeability in renewable energy.

making new grid investments and allocating grid capacity. As a corollary, it also gave them few incentives to invest in new transmissions connections for renewable energy resources, or to harden the power grid to effectively manage intermittent generation. In this context, the breakup of the power monopolies and the creation of independent markets for production, transmission, distribution, and use was a critical step in pushing for the adoption of low-carbon energy sources.[16] But even absent a mandate for renewable energy adoption, improved energy security would also require cross-border grid integration, to solve the inadequacy and energy island problems identified in sections 4.4.2 and 4.4.2.

Thus each of these three policy issues–emissions, security, and competitiveness–carries with it unique interests, both for and against, that would pose problems for attempts to pursue them in isolation. Instead, the EU energy and climate policy suite has evolved to yoke progress along any one policy dimension to progress along the others. The mix of costs and benefits to any one interest group or member state varies by the policy instrument, implicitly underwriting a political strategy of issue linkage between both interest domains and member states, and cross-subsidizing policy compliance. Finally, the ability to pursue all of these policies was highly contingent on the market reforms that enabled their implementation, and provided the private sector with incentives to pursue the investment necessary to achieve energy policy goals.

Political economy as a rebuttal to price fundamentalism

This analytic framework suggests that the arguments of the price fundamentalists miss the forest for the trees. As emissions policy alone, the ETS may be inefficient and cum-

[16] The proper regulation of the network assets in network economies has received significant attention amidst both the rise of the Internet and the privatization of state-owned network industries like rail. Two examples provide some insight: Much of the success of the internet hinged on ensuring that neither the network operator, AT&T, or the IT standards setter, IBM, could use monopoly control of markets to dictate terms of entry. Antitrust regulation of both firms (and, later, Microsoft) provided openings for new competitors. In contrast, the privatization of the rail network in the United Kingdom generated insufficient incentives for the network owner, Railtrack, to maintain and improve the network infrastructure. Breakdowns, delays, and systems decline resulted, at great cost to the British state.

bersome compared to a pure carbon price. As energy policy, the renewable energy mandates crowd out other, cheaper emissions-reducing fuels and efficiency investments. As market policy, energy market liberalization makes only partial sense in a world of massive, highly centralized fossil fuel generation plants.

But as table 4.2 shows, each of these policy instruments in fact serve multiple functional and distributional ends. Functionally, the support the integration of the European energy market, buffer renewable energy intermittency, reform monopolistic markets, support experimentation with and adoption of new energy technology at scale, and provide new forms of energy security. The benefits derived from these varied functions in turn provide the means of compensating rich and poor states alike, offsetting the costs of emissions reduction and generating near-term benefits that encourage policy stability and credibility.

Moreover, the varied policy targets–emissions, security, and competitiveness–provide greater flexibility to both EU and member state policymakers in justifying policy amidst a changing economic and political landscape. As the EU shifted from growth to recession in the 2008-2010 period, so too did the primary justification shift from climate change to job creation and firm competitiveness. The multiplicity of targets also allowed countries as diverse as Poland and Denmark to find accommodation inside the policy suite. Poland's response to the 2007 energy white paper (The Government of the Republic of Poland, 2006) emphasized security of supply and expanded use of domestic coal, and relegated the climate pillar of the policy proposal to third place. In contrast, Denmark emphasized renewable energy and reduced dependence on fossil fuels.(Danish Energy Authority, 2007, Appendix) Reconciling one set of interests to another required a means of both compensating Poland for participation and rewarding Denmark for taking on larger burdens. As this chapter has shown, the distributional patterns in the EU energy policy suite implicitly do both, by linking together emissions, security, and energy issue domains.

What we observe in the EU is, then, largely consistent with the predictions of the theory of political economy put forth in chapter 3. The EU has yoked progress on emissions to goals in energy security and industrial policy that promise short-term benefits. It has adopted policies to pursue those goals that both blunt the apparent cost of action and provide for implicit cross-subsidization of different policy domains. And, as policy has become institutionalized and stable, it has modified the policy regime–most notably with the turn to permit auctions after 2012–as policy actors have adapted to the emissions control framework and perceived as credible the mechanisms for cost management. The policy suite has thus permitted ongoing action on climate change, even as the original political climate has changed with EU enlargement, and the economic climate has changed from boom to bust.

In closing, critiques along the lines of those of Helm (2009) and Victor (2011) provide important insights into the actual and potential distortions of the EU's multi-faceted policy suite. But it is equally important to realize that there is a logic to the policy suite that goes beyond mere rent-seeking on the part of industries and member states. Rather, the structure of the energy policy suite appears to address the suite of political economy problems created by a low-carbon energy systems transformation. Improving the policy suite to improve effectiveness and reduce costs cannot focus only on resolving the problems of economic distortion created by the current suite. Rather, solutions must also identify how they would avoid exacerbating the political threats to policy continuity that the present system addresses. Finally, whatever the accuracy of the proposition that voters will probably need to pay more than they want for emissions reduction, haranguing them to do so (particularly amidst Europe's ongoing economic stagnation) appears unwise for both policy durability and electoral success.

4.8 Conclusions: managing functions and benefits in for low-emissions systems transformation in the EU

The European Union, intent on climate change mitigation, has yoked emissions reductions to the cause of energy security on the one hand, and the promise of innovation-driven jobs and growth creation on the other. In doing so, it has used the functional demands of a low-emissions energy systems transformation to create significant incentives for otherwise reluctant actors to maintain their commitments to emissions reduction. Eastern European member states concerned about the price of renewable energy nevertheless benefit from reduced dependence on uncertain foreign suppliers, and receive subsidies to offset the cost of investing in emissions-reducing assets and low-emissions energy sources. Northwestern European countries offset the costs of those subsidies with the expanded markets for the products of their high-technology industries. Emissions prices provide near-term signals for energy market evolution and efficiency, but mandated adoption of zero-emissions energy shifts some of the cost from acute emissions prices to diffuse subsidies for technology adoption.

This is not to say, of course, that the 2008 Climate and Energy package, and the present EU energy and climate policy suite, mark perfectly conceived instruments for the transformation of the EU energy system. As Jordan et al. (2011) have shown, the EU will continue to encounter significant questions of governance, cross-border harmonization, and policy feasibility. But emphasizing policy stabilization via issue linkage does not imply immobile policy. Rather, it suggests the institutionalization of a set of arrangements that permit policy evolution over time within a common framework.

Moreover, and in contrast to recommendations for "price fundamentalism", this analysis would suggest that, given the interaction of the EU climate and energy policy suite with the political interests at stake, the superficial inefficiency of EU climate policy is a feature, not a bug. Whatever its flaws–and it does no good to claim that the problems of rent-seeking and distortion do not exist–those flaws may be part and parcel of a sustainable policy regime.

Policy	Low carbon EST role	Other role	Political / distributional role	Primary beneficiaries
Market liberalization	• Promote new entrants w/ RES-E generation assets • Reduce barriers to new technology	• Create market mechanisms for cross-border trading of capacity and security goods	• Increase price competition to offset ETS, RES-E costs	• New energy market entrants • Energy users
Infrastructure planning & investment	• Buffer renewable energy intermittency	• Connect energy "islands" to central EU energy markets	• Improve energy security • Reduce weight of national legacy utilities	• Energy islands • Surplus power producers • Large RES-E share countries
Emissions trading	• Financial incentives for emissions-reducing investments and actions		• Implicit cross-national transfer mechanism via ETS permit allocation	• Eastern Europe • Small(er) firms
Renewable energy targets	• Bring new technology into the market • Provide learning-by-doing opportunities	• Provide non-fossil-fuel-based domestic energy resources	• Generate export revenues for firms in countries with larger ETS / RES-E targets • Improve energy security • Shift emissions reduction cost from acute ETS permit price to diffuse RES-E support	• Countries with comparative advantage in RES-E goods • Countries vulnerable to supply disruption
SET-Plan	• Invest in long-term low-emissions energy systems technologies	• Promote technological innovation in existing and new EU industries	• Promote near-term comparative advantage for EU firms and economies in growing export markets	• Countries and firms in the RES-E, energy efficiency, and energy services supply chains

Table 4.2: Distributional and functional contributions of major instruments in the EU policy suite.

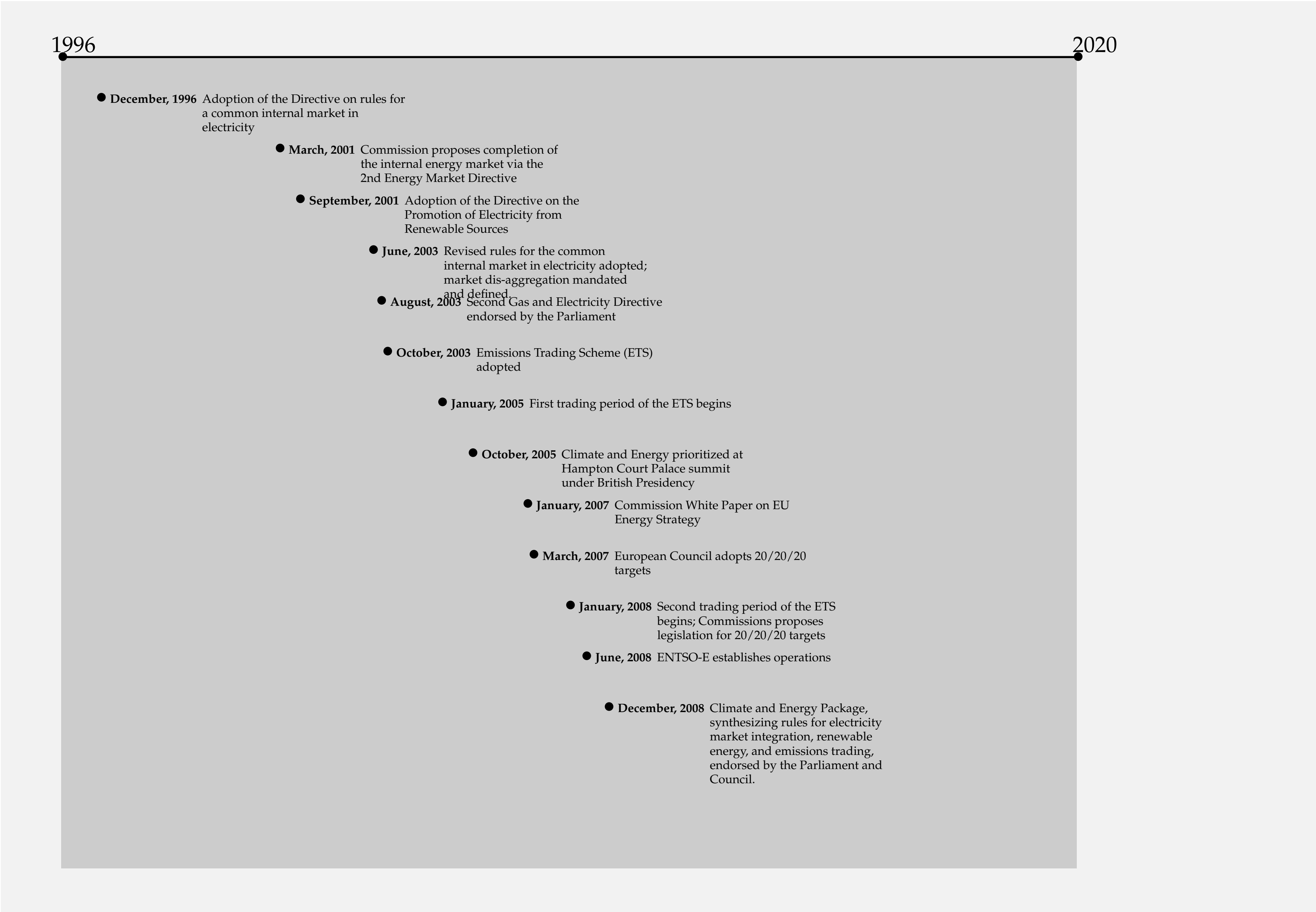


Figure 4.12: Timeline of EU Energy and Climate Policy