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Green growth as necessity and liability:

The political economy of a low-carbon energy systems transformation in the European Union

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In the last decade, energy systems transformation has become the new and unheralded frontier of European deepening. Starting in 1996, the European Union mandated the liberalization and integration of national energy systems, put a price on greenhouse gas emissions from electricity generation, established binding targets for renewable energy adoption, mandated the breakup of state energy monopolies, and sponsored the creation of EU-level regulatory and standards-setting bodies for energy infrastructure and markets. Most recently, the Europe 2020 program has established enforceable goals for the integration, liberalization, and decarbonization of the European electricity supply system, and ambitious but aspirational targets in energy efficiency.

Most analysis of this European policy history has emphasized the role of environmental politics in driving progress on emissions reduction. Appeals to environmental politics in this context appear to explain the apparent willingness of the European economies to trade off the economic costs of climate change mitigation for the perceived ecological and social benefits it might bring. Consistent with this understanding of the politics of European energy policy, green parties and social movements have been given significant explanatory weight.

This paper argues that the environmental politics approach falls short of a satisfying explanation for both the evolution of European policy and the characteristics of the policy suite. The attention to environmentalism, rather than to the details of European energy policy and the constraints of the current European energy system, overemphasizes the role of environmental concerns. It also leads to the conclusion that the European policy suite may be fundamentally unstable–prone to reversal when the costs of environmental action exceed the altruism of European publics. This poses particular problems when faced with the fact that progress on emissions and renewable energy continued even after European enlargement added 12 member states with significantly less enthusiasm for climate change mitigation and significantly greater reliance on fossil fuels.

Instead, European policy must be understood as an attempt to transform the energy system amidst, on the one hand, the need to maintain a stable political coalition of EU member states supportive of the transformation; and, on the other, the technological and economic complexity of the energy system. This trifecta of constraints–political, technological, and economic–complicates the process of policy design. But it also improves the prospects for sustaining policy through cross-subsidization across policy domains. These constraints and opportunities arise from the common role played by energy in emissions, security, and technological change. That role is closely intertwined with the possibilities for technological change in the energy system. Thus only by understanding both the technological challenge of energy systems transformation, and the political conflicts implicit in that transformation, can we understand the resulting policy suite.

1 Green parties for green energy? Competing explanations for EU policy leadership

While the energy sector itself accounts for only 2-4% of European GDP, the central role of energy in modern industrial society gives changes to the energy system importance far in excess of their immediate economic valuation. Today, Europe's energy system provides abundant, reliable, relatively inexpensive energy. Disruption of any of these characteristics would pose major challenges to the rest of the economy. Thus it is not surprising that both the European Union and its member states have approached climate and energy policy as an attempt to restructure the inputs to the energy system while leaving the outputs untouched. Technologically, that has meant switching away from imported fossil fuels towards domestic renewable energy. Economically, this has meant marketization of the energy system; dismantling of vertically-integrated state-owned energy firms; and differential regulation of energy production, distribution, and use. These initiatives all seek to accomplish the decarbonization of European energy supplies and the integration of European energy markets while leaving the industrial superstructure of the European Union unperturbed.

On their own, these technical and regulatory changes pose significant challenges. Ongoing changes in the political landscape of the European Union have only compounded these challenges. Europeanization of energy policy has taken place amidst an enlargement program that has made Europe's climate and energy interests more, not less, diverse. The industries of eastern Europe and the Baltic states in particular were more dependent on greater quantities of less expensive carbon energy than their Western counterparts. The publics in those countries were less enthusiastic about climate change mitigation, and more likely to support exploitation of domestic fossil fuel resources–many of which, like Polish lignite coal, were particularly dirty energy sources. Yet despite the increased diversity of interests, the EU continued to make progress after enlargement on the decarbonization of the energy supply and the deployment of more expensive renewable energy.

Explaining this ongoing progress poses two challenges for policy analysts. First, most contemporary accounts of European progress in energy systems transformation or climate change mitigation have relied on either domestic party structures–the role of green parties in particular–or foreign policy entrepreneurship–chiefly leadership in the United Nations COP process–to explain ongoing progress.[2] Yet energy reform has continued despite the enlargement of the EU to include countries without strong green movements; and amidst the return of center-right parties to government in countries like Denmark, Germany, and the United Kingdom.[3] Furthermore, the failure of EU

[2]See, for instance Jacobsson and Lauber (2006) on German renewable energy policy, **?** on the origins and content of the Emissions Trading System legislation, and Schreurs and Tiberghien (2007) on EU climate and energy policy.

[3]Indeed, amidst extreme austerity measures in the United Kingdom under the Conservative-Liberal Democratic coalition after 2010, one of the few things that has not been cut is the UK's aggressive plan for energy investment and market restructuring.

policy leadership to secure binding emissions targets at the 2009 COP-15 negotiations has made no appreciable difference to the goals of EU climate policy.

Second, these political accounts of Europe's energy systems transformation have little to say about the particular contours of European policy. The choice of a policy suite that includes a carbon emissions trading system, a renewable energy mandate, and energy market liberalization is in many cases at odds with European green parties' preferences. Indeed, if the green parties were as important to policy outcomes as is claimed, we would expect to see much more radical policy than we do: more aggressive targets, less dependent on market-based instruments like carbon pricing, founded on a stronger critique of the ecological and equity costs of capitalism.[4] Moreover, progress on both energy market reform and emissions reduction has continued despite, as in Denmark and Germany, the return of center-right parties to government.[5]

Beyond these theoretical arguments, an improved understanding of the policy rationale at work in Europe is critical for two purposes. First, it provides a response to the self-styled "price fundamentalism" of economic analysis.(Nordhaus, 2010) Such fundamentalism usually leads to the conclusion that the EU policy mix represents an inefficient departure from a ideal price-based emissions control mechanism. But this conclusion arises from an emphasis on emissions reduction to the exclusion of other policy prerogatives, and in doing so obscures the potential reality that, absent this policy suite, the political economy of energy and climate policy would not have tolerated a carbon price at all. The choice, in other words, was not between the first- and second-best, but between the second best and nothing.

Furthermore, a better understanding of the policy rationale will improve our ability

[4]See, for instance, the European Greens' 2009 election manifesto, which called for sweeping environmental reforms and an explicit tradeoff of productivity for employment in environmental goods industries (European Greens Party, 2009; Schepelmann et al., 2009).

[5]Indeed, in early 2011 the Danish center-right government released a highly ambitious domestic energy and climate policy platform that exceeded the expectations of nearly every major opposition party. Interviews in Denmark shortly after the platform was released indicated that this will probably set the terms of the debate for the 2011 election and subsequent energy policy choices. See **?**.

to predict the success and longevity of the policy itself. To a great degree, the stability of the European energy policy suite relies on spillover benefits in energy security and competitiveness to justify ongoing emissions reduction. This "green growth" strategy promises to turn on its head the core problem of climate change mitigation–the trade-off of present consumption for future benefits–by reconciling emissions reduction to economic growth in the present. If successful, this would mark a radical shift in the potential for serious emissions reduction. If not, it marks a critical weak point in European ambitions and an implicit limit to the tolerance for the costs of emissions reduction.

2 The European Energy Policy Suite

As of 2010, the EU has deployed a range of policy mechanisms to reduce emissions, secure energy supplies, and incentivize energy sector innovation. This suite of policies should be seen as an attempt to simultaneously address three energy-centered externalities: global climate change; energy security and price instability; and competitiveness and technological innovation. The existence of multiple energy-related externalities complicates the problem of policy formation. But it also provides 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.

2.1 Progress in European energy policy, 2000-2010

As for 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.[6]

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(Jamasb and Pollitt, 2005).

4. The SET-Plan and Framework Programmes, which provide significant European and Member state funding for research, development, and deployment of new energy technologies(European Commission Staff, 2009; The European Commission, 2007b; European Commission, 2009).

Figure 5 shows that this policy suite did not arrive at once–rather, it evolved over time. As it did so, the political justification for each policy evolved as well. The liberalization of the energy market began in 1996 as a fairly standard extension of the Common Market, in parallel with other EU attempts at services and goods market integration.[7] In its initial form, the European Commission justified the program on the basis

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

[7]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. Some regions–notably the Nordpool market in Scandinavia–had accomplished electricity market integration outside of the European Union. Now that grid policy has become a European competence, the ENTSO-E body has been tasked with this process. But the EU has relatively little experience in standards-based market integration.

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 network connection and market reform. Those reforms were extended and deepened via the 3rd market directive, issued as part of the 2008 Climate and Energy Package.

In contrast to these market reforms, which have a long history in European widening and deepening, the Emissions Trading Scheme 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.[8] 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. Economic costs figured heavily in this decision. Since the majority 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 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 (via the indirect mechanism of emissions permit purchases) 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.

In 2007, two years into the operation of the ETS, the Commission proposed strengthening the ETS and implementing aggressive targets for renewable energy deployment. In what became the so-called 20/20/20 goals, the 2007 Commission white paper (The European Commission, 2007a) proposed that, by 2020, Europe obtain 20% of its en-

[8]The Kyoto Protocol's carbon market mechanism was actually something foreign to the European Union. The EU member states had traditionally preferred top-down regulatory instruments for environmental policy. They agreed to the permit trading concept at the insistence of the United States. Despite the latter's withdrawal from the Kyoto Protocol, the European Union continued with the framework and its price and quantity instruments.

ergy from renewable sources, use energy 20% more efficiently, and reduce emissions by 20% relative to 2005 levels. To do so, it proposed moving beyond the emissions trading scheme to use direct subsidies to renewable energy–so-called feed-in tariffs or other support schemes–to incentivize renewable energy adoption and decarbonization of energy production.[9] This proposal was eventually adopted in December 2008 as a set of legislation known as the 3rd Climate and Energy Package.[10] In addition to the renewable energy and emissions targets, the Package also provided for EU-level coordination of national energy market regulations, established an EU-level energy regulator, and reinforced the mandate for the breakup of vertically-integrated national electricity monopolies into separate markets for production, transmission, distribution, and retail.

Finally, the EU has moved to implement significant support for energy R&D relative to its budget. The Strategic Energy Technology Plan (European Commission, 2009) laid out a series of innovation and pilot program investments seeded with EU funding but completed by consortia of private corporations and member states. Those investments complemented existing investments in energy R&D in the 7th Framework Programme, which invested €2.3 billion in energy-related research over the period 2007-2013.

2.2 Policy redundancy in the EU emissions reduction suite

This energy policy suite marks a major accomplishment for the EU. It has significantly expanded EU authority over a major sector of the European economy. It has created new EU institutions that usurp some member state authority over energy market regulation. It has led to the formal or legal dismantling of state-owned energy monopolies,

[9]The European Court of Justice played a critical role in the evolution of feed-in tariffs. Many of the member states had adopted feed-in tariffs in the 1990s, but doubts remained as to whether they constituted illegal state aid under the Common Market regulations. A 2001 ECJ decision (?) confirmed the legality of feed-in tariffs and paved the way for their adoption across the EU.

[10]Timing here proved critical. 2009 saw a rapid worsening of the European economic situation and financial crises in a series of peripheral economies. Interviews with a variety of EU and member state policymakers in late 2010 and early 2011 confirmed that the Climate and Energy package would not have passed under those circumstances. The decision of the French Presidency to push for ratification at the end of its term played a critical role in institutionalizing the Commission's white paper.

foot-dragging by Germany and France notwithstanding. All these developments have given the EU new influence of the evolution of the rest of the economy, via regulation of how energy is produced, distributed, and used.

But, theoretically, much of this policy should not be necessary for the EU's climate policy goals. Emissions reductions, in particular, should not require parallel programs to incentivize renewable energy, energy efficiency, or research and development. Rather, the consistent message from economic analysis has emphasized the primary of the carbon price alone.[11] Given the right emissions price, market actors should of their own accord determine the most efficient way to optimize their investment in greenhouse gas emissions reduction. By this argument, separate policies to promote renewables and push energy efficiency may constitute market-distorting industrial policy.[12] Indeed, it now appears that most of the 2020 emissions goals in the EU will be satisfied through widespread deployment of renewable energy, even though many cost estimates (such as Enkvist et al. (2007)) show that energy efficiency improvements are often much cheaper.

This problem only compounds other issues of the design of the ETS itself: rights to emit are granted via the member states, rather than auctioned by the EU, leading to all kinds of chicanery among the member states[13]; allocation is based on prior-period emissions, providing perverse incentives to over-emit and thus keep the baseline high; and the price of emissions permits on the secondary market has proven somewhat volatile and unpredictable. All of these institutional designs raise the price of emissions and

[11] This has developed into a self-styled "carbon price fundamentalism." Nordhaus (2010) notes that "under limited conditions, a necessary and sufficient condition for an appropriate innovational environment is a universal, credible, and durable price on carbon emissions." The potentially infinitesimal intersection of the limited economic conditions he refers to, and the limited political conditions that would lead to a "universal, credible, and durable" price, poses major problems.

[12] For public criticism of such parallel efforts, see Schmalensee and Stavins (2011). For attempts to quantify the differential cost of emissions reduction via renewable energy incentives versus emissions pricing, see Palmer and Burtraw (2005).

[13] Germany and Poland both had their drafts of the Phase II National Allocation Plan denied by the European Commission, on the grounds that they used allocation as a kind of *de facto* state aid policy that interfered with the functioning of the internal market.

reduce the effectiveness of the ETS.[14]

This gap between theory and policy implementation is puzzling in light of the political economy of climate change action. Climate change poses fundamental policy problems because it imposes immediate, acute costs to achieve diffuse benefits far in the future. Achievement of 50-80% reductions in absolute emissions levels over the course of the 21st century will require significant investment in new energy infrastructure[15], as well as potentially large changes in the structure of cities and suburban areas, the methods used in agriculture, and the operations of a wide range of other sources of emissions. Because global climate change depends on the stock, rather than the flow, of carbon emissions, those changes must begin fairly soon, even if their unabated effects would not occur until far in the future. Finally, when implemented, they would result in nothing more than a world that looks largely like the one we know today–perhaps a bit warmer, given damage already done. In other words, the benefits as classically conceived come entirely through relative and largely invisible cost-avoidance, rather than absolute and tangible improvement.

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 reject 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 suggested 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.

[14]The EU has recognized many of these problems. The third phase of the trading system, beginning in 2013, will use auctioning rather than free allocation to improve the efficiency of the system and reduce opportunities for collusion. Much of the demand for a shift to auctioning appears to have come from firms, who could not rely on smooth adjustments to their allotment quotas under the free allocation system.

[15]Energy Commissioner Öttinger has called for €1 trillion in energy infrastructure investment alone.(The European Commission, 2010) Whether this will materialize in an age of budget austerity remains to be seen.

This is all the more surprising given that the Renewable Energy standard was adopted *after* the accession of the new member states. As figure 2 showed, these new member states were considerably more reliant on energy and on fossil energy than the EU-15. Given that the EU-15 were already concerned about potentially detrimental effects of carbon pricing on competitiveness, the addition of 12 new members with even greater concerns should have made progress even more fraught. Under any theory of policy formation that gives primacy to efficiency and cost minimization, we would expect that this would make the EU more likely to pursue carbon pricing as the low-cost option. But this did not occur.

3 Complementarity, not redundancy: climate policy as energy policy

This portrayal of the puzzle of policy redundancy relies on viewing policy goals as *either* climate *or* energy focused. This is incorrect. European Union actions on climate and energy cannot be separated. Analytically, such a separation fails to account for the vital role played by the energy system in any serious attempt at emissions reduction. Politically, this separation ignores the immediate conflation of climate and energy goals and interests–and the political battles this brings–that occurs as soon as an emissions price is introduced. Substantively, it fails to recognize the underlying technological characteristics of the European energy system, the profound barriers to change those characteristics pose, and the actions required to overcome these barriers.

3.1 Climate between energy and security

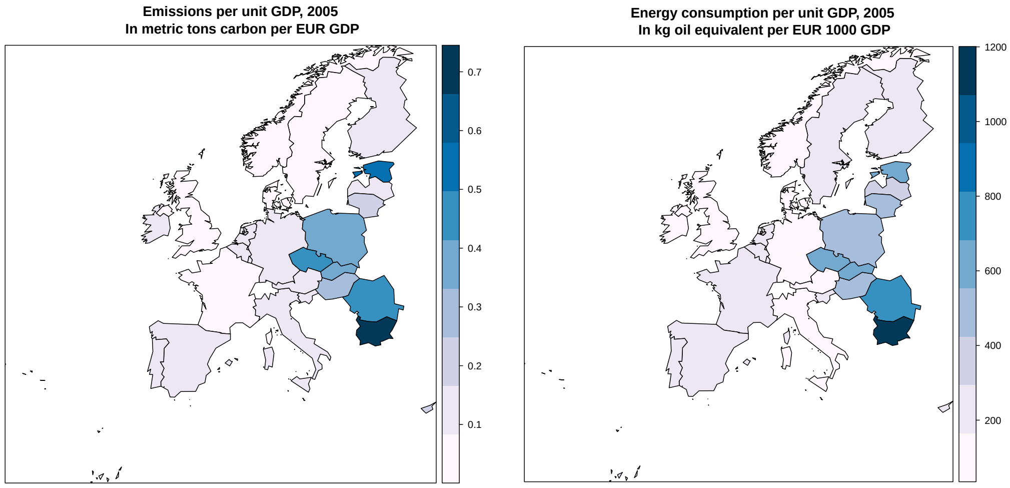
Resolving these analytic failures must begin with the recognition that EU policy is optimizing across three separate externalities: emissions, energy security, and economic competitiveness.[16] But those externalities are closely connected to each other via mutual dependence on the energy system. Implicitly, solutions to any one of them suggest some form of energy systems transformation.

This has two important consequences. First, because of the variation in national energy markets, summarized in figure 1, the importance of each externality varies by member state. Spain and Portugal are energy islands due to the isolation of the Iberian peninsula; most of eastern Europe remains dependent on fossil fuels, either domestic coal or gas imported from Russia; Denmark is, at least for the near term, a net energy exporter that has decoupled GDP growth from energy consumption; France has already decarbonized 80% of its electricity supply through reliance on nuclear energy. These national differences in the structure of energy production, distribution, and use alter the importance that each member state attaches to the goals of competitiveness, energy security, and emissions reduction.

Second, isolated solutions to one externality may well exacerbate the others. Thus pursuing individual solutions to each of these externalities could well fracture the coalition required to maintain policy at all. The climate policy mix, therefore, should be viewed not as an attempt to resolve the emissions externality alone, but to optimize policy within the constraints imposed by these three energy-related externalities.

Those constraints come in two parts. Politically, each externality has its own constituency inside the EU. Energy security is most salient for the new member states, whose exposure to Russian influence through their dependence on energy was made clear by the 2005-2006, 2007-2008, and 2009 Ukraine gas crises. The western European states, who depend less on Russian energy, are correspondingly less concerned (though balance-of-payments concerns over imported fossil fuels remain salient). Emissions reduction is most important to some states with strong green parties, and to those who

[16] This mantra has become a common feature of energy policy documents originating in the Commission, starting with the 2007 energy strategy white paper. Interviews with Commission staff in late 2010 suggested that, even within the Commission itself, opinions as to the relative importance or attainability of each goal varied greatly; and that the emphasis on any one of the three varied over time.



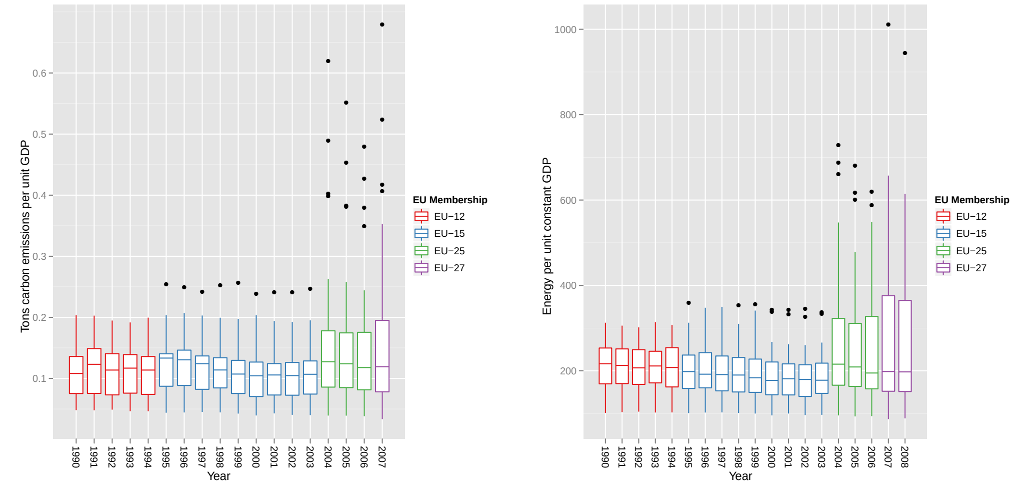
(a) Emissions intensity per unit GDP

(b) Energy intensity per unit GDP

Figure 1: 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.

view European climate leadership internationally as vital. But states with relatively high carbon energy shares view emissions reduction as a potential drag on economic competitiveness. Competitiveness, of course, is a universal concern: but states with strong renewable energy technology industries (like Denmark or Germany) stand to benefit substantially from EU-wide emissions reduction programs, while other states may become net importers of these technologies. Thus each policy domain has separate, though sometimes overlapping, member state constituencies.

Optimizing along any one externality would risk fracturing the coalition along these lines. Pursuing emissions reduction through a high emissions price would have two immediate effects: first, it would substitute Russian 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 might lead to defection by member states concerned



(a) Emissions intensity per unit GDP (b) Energy intensity per unit GDP

Figure 2: Emissions and energy intensity of economic activity in the EU across enlargements. Emissions data are expressed as metric tons of carbon per constant 200 €. 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 MMT Carbon.

about energy security and reduced economic competitiveness.

Likewise, pursuit of energy security alone would lead to significantly greater use of domestic EU coal. Much of the remaining coal in Europe, such as that around Silesia in Poland, is of the soft brown lignite(World Energy Council, 2010) variety, which in addition to its carbon emissions carries a much higher share of other pollutants compared to the hard coal of earlier generations. This would alienate member states more committed to emissions and pollution reduction, and frustrate EU attempts to achieve its commitments under the Kyoto protocols.

Furthermore, 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.[17] But that would come

[17]This, of course, is limited to the case in which each member state had binding targets without trade-

at large costs to technology-importing countries, both in absolute terms and in the secondary effects on trade balances.

Finally, linkage of security, competitiveness, and climate change goals was made easier by energy market reform. Adoption of significant volumes (> 20%) of non-hydroelectric renewable energy–a cornerstone of energy security, emissions reduction, and competitiveness policy–poses significant challenges to the power grid. Technologically, the intermittency of most renewable energy sources can destabilize the power grid and lead to supply disruption. Those problems can be offset through grid reinforcements and investments in new technologies. Making those investments, 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 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.[18]

Thus each policy problem carries with it unique interests for and against that would frustrate 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 varies by

able 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.

[18]Huberty et al. (2011) analogize energy systems transformation to earlier technological transformations like information and communications technology (ICT). Cognizant of the differences between ICT and energy, the breakup of vertically-integrated energy systems bears some relationship to the United States government's antitrust actions against the AT&T telecom monopoly. In both cases, policy action has attempted to facilitate innovation on the network by separating control of the network from control of the devices and services that operate on it. Whether this will work for energy the way it did for ICT remains to be seen.

the policy instrument, implicitly cross-subsidizing policy compliance. The ability to pursue all of these policies was highly contingent on the market reforms that enabled their implementation. Linking these policy areas together could occur because of the central role played by the energy system and energy systems transformation in each individual policy domain.

3.2 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 cumbersome 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 in practice, the policies manage the tradeoffs between each of the three externalities. The renewables mandate accomplishes four ends: it provides emissions reduction largely through renewable electricity adoption; it expands domestic renewable energy markets, generating profits for firms in renewable energy leaders like Denmark and Germany; it provides indigenous energy substitutes not subject to Russian influence; and it shifts the cost incidence of emissions reduction from retail electricity prices to subsidies paid, at least partially, from general taxation.

Absent some means of subsidization, the renewables mandate might generate opposition among either those less concerned with emissions or those net renewable energy technology importers. But the Emissions Trading Scheme, together with reallocated EU Structural Adjustment Funds, provides a regulatory framework for implicit cross-subsidization. As Zachmann (2011) has shown, the new member states–for whom energy security via renewables is more expensive than via domestic coal–receive relatively more permits than they should compared with historic baselines. Conversely, countries like Germany and Denmark–who stand to benefit from the expansion of the renewable energy market–receive relatively fewer.[19] Since those permits have value on secondary markets, this represents an implicit subsidy to the same member states who are most exposed to the costs of renewables-led emissions reduction. Thus the renewables mandate solves the security problems of new energy sources, and generates significant income for some member states. But some of that income is recycled via the ETS permit process, cross-subsidizing energy security via renewables rather than domestic coal.

Finally, the pursuit of emissions reduction raises concerns about European competitiveness in the face of high energy prices. To offset these concerns, both the renewable energy mandate and the ETS provide compensating incentives. First, renewable energy has become a significant area of European comparative advantage. Maintenance of that advantage will require ongoing innovation. As a range of studies have shown, many aspects of energy innovation respond better to learning by doing than by laboratory or "big science" research alone.(Heymann, 1998; Kamp et al., 2004; Meyer, 2007; Acemoglu et al., 2009) The renewables mandates, by expanding the market for installation of new technology, provide the means for that kind of innovative activity. Meanwhile the emphasis on energy technology support in the SET-Plan and the Framework Programmes underpins basic research. Economically, these programs intend, at least, to generate significant innovation and job growth via investment in new high-technology sectors. Politically, they create new constituencies of firms and workers supportive of emissions reduction, offsetting the acute costs of emissions mitigation with the acute benefits of industrial competitiveness.

[19] Note that this will persist even after the move to auctioned permits. Auctioning will only control initial allocation within member states, not between them. Burden-sharing will still govern member state quotas under the ETS, and the member states retain the rights to use auction revenues however they see fit.

4 Green growth and the European Union

This study has so far demonstrated that European Union climate policy cannot be understood in reference to emissions reductions alone. Were that the case, a range of simpler, and potentially even cheaper, alternatives for climate change mitigation might have emerged as preferred policy options. Instead, the European Union has, whether by design or not, embarked on a policy suite that couples progress on emissions reduction to action on energy security and economic competitiveness. Doing so has allowed the cross-subsidization of different policy goals between the member states, keeping political coalitions for action together where action on only one goal might have generated defection.

In doing so, the EU has embarked on a strategy that knits together many of the "green growth" proposals discussed in Huberty et al. (2011). Improved competitiveness from reduced reliance on imported fossil fuels, export-led growth in renewable energy industries via market promotion at home, and revenue recycling from emissions pricing to research and development all represent prominent green growth strategies. That the EU understands this is clear from statements by the Commissioners themselves. Commissioner for Energy Günther Öttinger argued for increased European spending on low-emissions energy technologies by stating that "in global competition we need to avoid that we start lagging behind China and the USA."[20] EU Commissioner for Climate Action, Connie Hedegaard, has also endorsed the growth potential of climate change mitigation.(**?**)

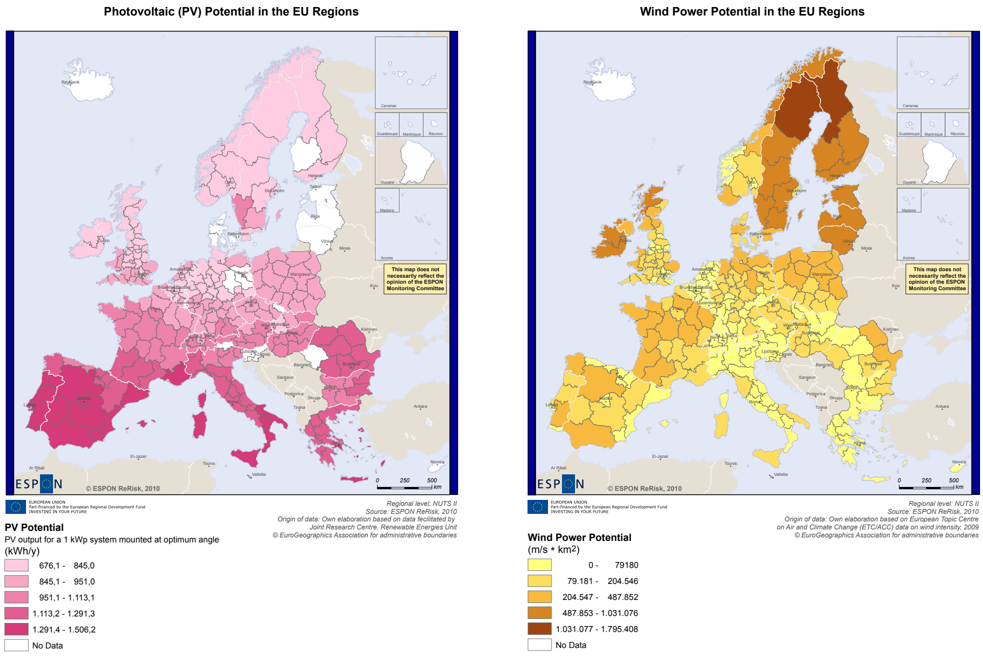
Many of these strategies have worked well for individual member states. Denmark has profited from both export-led growth in the wind turbine industry and increased global competitiveness through insulation from fluctuating fossil fuel costs. Germany has done well through promotion of renewable energy firms like Siemens at home

[20] Speech of Commissioner Öttinger at ENERI 2010, Belgian Presidency Conference on Infrastructure of Energy research. Brussels, 29 November 2010.

(though as Frondel et al. (2009) show, that has come at a very high cost, particularly for solar energy technologies). Portugal and Spain both sought to use domestic market expansion to drive export competitiveness abroad and industrial redevelopment at home.(Rosenthal, 2010) Finally, a range of countries, from the United Kingdom to Poland, view offshore wind energy as new source of demand for skilled labor displaced from declining sectors such as offshore gas and oil exploration (in Scotland) and shipbuilding (in Poland).

As Huberty et al. (2011) noted, though, each of these strategies remain limited in scope and potential duration. In the case of the European Union, two threats in particular stand out. First, the process of market integration, critical to cost containment, has run into various regulatory problems on the ground. This is principally true in the case of power grid integration. Integration of renewable energy in the European power grid will be cheaper and less complex if accompanied by integration of the current regional energy markets. By averaging intermittency and resources over a wider geographic range, market integration can improve the stability of the power grid and lower the price of renewable electricity. As figure 3 shows, a European grid capable of drawing wind energy from northern Europe and solar energy from southern Europe would allow averaging of renewable power production across the entire European continent.

But actually building the power grid interconnectors required to make this a reality has encountered two significant problems. First, local resistance to new power lines has delayed new interconnector construction. Discussions with several European energy firms in late 2010 suggested that the time from project announcement to the start of operations could be as long as a decade. Second, potential solutions to local resistance–chiefly burying cables to minimize their aesthetic impacts–face significant



(a) Photovoltaic electricity generation potential (b) Wind electricity generation potential

Figure 3: Wind and solar photovoltaic power generation potential maps for the European Union. Source: ESPON Regions at Risk of Energy Poverty (ReRisk) project.

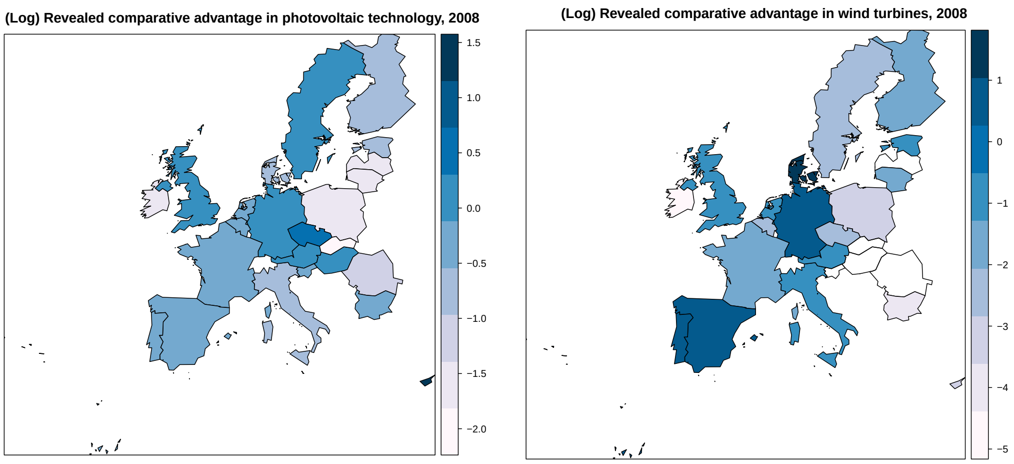
technical hurdles[21] and raise construction costs dramatically.[22] Thus despite ambitious goals for EU-level adoption of renewable energy and reform of power markets, the disconnect between EU-level goals and local regulatory and political reality may slow progress and increase costs.

The second potential problem comes from the political economy of the Common

[21]This problem is unique to alternating-current transmission. The interface between the cable and the surrounding earth functions as a capacitor. Polarity-switching alternating current thus dumps most of its energy into charging and discharging that capacitor, to the point where line losses become very large. Solutions include use of direct current transmission (over very long distances) or shortening of the effective underground cable length through periodic above-ground stations.

[22]See, for instance, the 2008-2009 agreements among the Danish political parties and with the Danish network operator, Energinet.dk, on future construction of interconnectors in western Denmark. The agreement approved the construction of what will be Denmark's last new above-ground transmission line. It also set a framework for moving most of the high-voltage transmission infrastructure underground, albeit at significantly higher cost. See "Undergrounding of 132-150kV grids", at `http://energinet.dk/EN/ANLAEG-OG-PROJEKTER/Infrastructure-projects-electricity/Sider/Cable-laying-of-132-150kV-grid.aspx`. Accessed 5 April 2011.

Market itself. Presently, significant disparities in competitiveness in renewable energy technology exist among different EU member states. Given the lack of tariff barriers inside the EU, mandates to adopt renewable energy technology may exacerbate, rather than even out, these disparities. This hearkens back to earlier debates about the impact of the Euro and a common monetary policy on member state heterogeneity. Then, the debate over optimum currency areas turned on whether a common monetary policy would generate convergence of business cycles among the member states; or, alternatively, reduce transaction costs, and so increase the specialization and heterogeneity of the EU economies.(**??**) Now, the question is whether renewable energy standards will provide new industrial opportunities to all member states, or instead generate substantial windfall profits for already-competitive firms in specific member states.



(a) Photovoltaic solar cells

(b) Wind turbines

Figure 4: Geographic disparities in regional comparative advantage for renewable energy products. All data shown for 2008. Revealed comparative advantage calculations based on the 6-digit United Nations COMTRADE data and are shown as base-10 logs.

5 Conclusions: risks and opportunities for green growth in the European Union

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 created significant incentives for otherwise reluctant actors to maintain their commitments to emissions reduction in the face of the costs. 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 costs. 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 not at levels that would generate significant political backlash. 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.

Whether that translates into "green growth" is, of course, a different matter. As we have seen, EU policy faces obstacles to policy implementation and economic solidarity stemming from the dynamics of renewable energy adoption. Hopefully, the gains from "green growth" will remain large enough to help offset the costs implicit in these obstacles. If so, then the strategy of cross-subsidization of interests can remain viable and help sustain emissions reduction in the future. If not, however, EU policy will face significant challenges in sustaining the transition to a low-emissions economy.

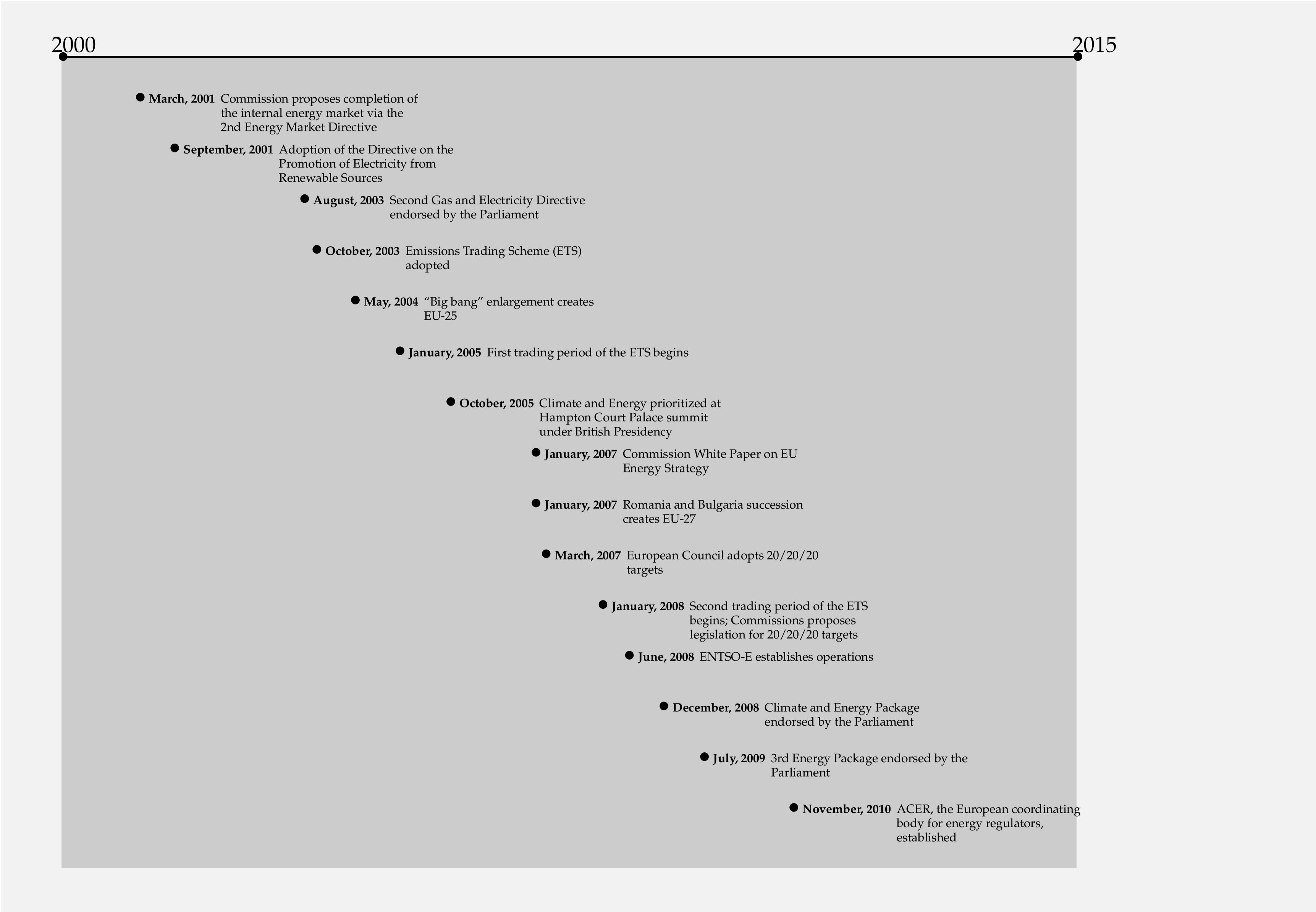


Figure 5: Timeline of EU Energy and Climate Policy

References

Acemoglu, D., P. Aghion, L. Bursztyn, and D. Hemous (2009). The environment and directed technical change. NBER Working Papers Series 15451, National Bureau for Economic Research.

Enkvist, P., T. Nauclér, and J. Rosander (2007). A cost curve for greenhouse gas reduction. *McKinsey Quarterly 1*, 34.

European Commission (2009, October). Investing in the development of low carbon technologies (SET-Plan). Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions COM(2009) 514, The European Commission, Brussels, Belgium.

European Commission Staff (2009, October). A technology roadmap for the communication on investing in the development of low carbon technologies (SET-Plan). Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions SEC(2009) 1295, European Commission, Brussels, Belgium.

European Greens Party (2009). A green New Deal for Europe: Manifesto for the European election campaign 2009. Press release, The European Greens Party, Brussels, Belgium.

Frondel, M., N. Ritter, C. M. Schmidt, and C. Vance (2009). Economic impacts from the promotion of renewable energy technologies: The German experience. Ruhr Economic Papers 156, Rheinisch-Westfälisches Institut für Wirtschaftsforschung, Essen, Germany.

Heymann, M. (1998). Signs of Hubris: the shaping of wind technology styles in Germany, Denmark, and the United States, 1940-1990. *Technology and Culture 39*(4), 641–670.

Huberty, M., H. Gao, and J. Mandell (2011, April). *Shaping the Green Growth Economy: a review of the public debate and the prospects for green growth*. Copenhagen, Denmark and Berkeley, California: Mandag Morgen and the Berkeley Roundtable on the International Economy.

Jacobsson, S. and V. Lauber (2006). The politics and policy of energy system transformation—explaining the German diffusion of renewable energy technology. *Energy Policy 34*(3), 256–276.

Jamasb, T. and M. Pollitt (2005). Electricity market reform in the European Union: review of progress towards liberalisation and integration. MIT-CEEPR Working Paper 05-003WP, MIT Center for Energy and Environmental Policy Research, Cambridge, Massachusetts.

Kamp, L., R. Smits, and C. Andriesse (2004). Notions on learning applied to wind turbine development in the Netherlands and Denmark. *Energy policy 32*(14), 1625–1637.

Meyer, N. (2007). Learning from wind energy policy in the EU: lessons from Denmark, Sweden and Spain. *European Environment 17*(5), 347–362.

Nordhaus, W. D. (2010, May). Designing a friendly space for technological change to slow global warming. Working paper, Yale University, New Haven, CT.

Palmer, K. and D. Burtraw (2005). Cost-effectiveness of renewable electricity policies. *Energy Economics 27*(6), 873–894.

Rosenthal, E. (2010). Portugal gives itself a clean-energy makeover. *The New York Times Green Blog 9 August*, A1.

Schepelmann, P., M. Stock, T. Koska, R. Schüle, and O. Reutter (2009, September). A green New Deal for Europe: Towards green modernization in the age of crisis. Green New Deal Series 1, Green European Foundation and the Wuppertal Institute for Climate, Energy, and the Environment, Wuppertal, Germany.

Schmalensee, R. and R. N. Stavins (2011). Renewable energy standards: less effective, more costly, but politically preferred to cap-and-trade? *Grist.org 11 January*.

Schreurs, M. and Y. Tiberghien (2007). Multi-level reinforcement: Explaining European Union leadership in climate change mitigation. *Global Environmental Politics 7*(4), 19–46.

The European Commission (2001, March). Completing the internal energy market. Communication from the Commission to the Council and the European Parliament COM(2001) 125, The European Commission, Brussels, Belgium.

The European Commission (2007a). An energy policy for Europe. Communication to the European Parliament and European Council SEC(2007) 12, Commission of the European Communities, Brussels, Belgium.

The European Commission (2007b, November). A European strategy energy technology plan (SET-Plan). Communication from the Commission to the Council, the European Parliament, the European Economic and Social Committee and the Committee of the Regions COM(2007) 723, The European Commission, Brussels, Belgium.

The European Commission (2010). Energy infrastructure priorities for 2020 and beyond - a blueprint for an integrated European energy network. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions COM(2010) 677, The European Commission, Brussels, Belgium.

The Government of the Republic of Poland (2006, October). The standpoint of the government of the republic of poland on the green paper: A european strategy for sustainable, competitive and secure energy com (2006) 105. Response to the european green paper on european energy strategy, European Commission.

World Energy Council (2010). *2010 Survey of Energy Resources*. World Energy Council.

Zachmann, G. (2011, January). Is European climate policy the new CAP? Bruegel Policy Brief 2011/01, Bruegel, Brussels, Belgium.