



The EU Emissions Trading System

Results and Lessons Learned

EXECUTIVE SUMMARY

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Executive summary

Unless otherwise indicated, this report uses the terms “EU ETS” and “ETS” to refer to the European Union Emissions Trading System.

The European Union Emissions Trading System (EU ETS), the world’s first and largest multi-national cap-and-trade program to limit global warming pollution, has driven significant reductions in greenhouse gas emissions since the program’s inception in 2005,¹ sparked innovation in low-carbon processes,² and achieved results at an estimated cost of just 0.01% of gross domestic product—a fraction of predicted costs.³ The EU ETS has been established and extended over three successive phases: Phase I (2005–2007, often called the “pilot phase”); Phase II (2008–2012); and Phase III (2013–2020). The EU appears to be on target and in fact ahead of schedule for achieving the ambitious emission reduction target set for the years 2008–2012, in large measure because of the success of the EU ETS. As with any innovative policy measure, the EU ETS has stumbled in places, and policymakers should understand the lessons learned from its faults and subsequent reforms. For instance, because EU governments based the system’s initial caps and emissions allowance allocation on *estimates* of regulated entities’ emissions rather than on *actual historical emissions data*, governments issued too many emissions allowances (“over-allocation”).⁴ Now, however, caps are established on the basis of measured and verified past emissions and best-practices benchmarks, so over-allocation is less of a problem.

One central finding from seven years of experience with the EU ETS has emerged: Despite initial dire warnings⁵ that the ETS would impede economic growth by dramatically increasing costs to consumers and industry, the evidence shows that the ETS has played a significant



The EU Emissions Trading System has played a significant and successful role in reducing Europe’s global warming pollution at lower-than-expected cost, and is proving to be a practical, efficient way to spur innovation in a low-carbon economy.

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and successful role in reducing the EU's global warming pollution at costs a fraction of those predicted.

The EU ETS is working. Most importantly, it is working *now*—on the ground and in the atmosphere. It is proving itself a practical, efficient way to spur innovation and reduce greenhouse gas emissions. In addition to driving emission reductions, the EU ETS can be seen as an economic development tool—together with other complementary policies, it has stimulated innovation in the emerging European low-carbon economy, as case studies provided in Appendix A to this report illustrate. Recent debates about the fluctuating price of emissions allowances should not obscure these environmental and economic successes. As even one commentator critical of some aspects of the EU ETS has noted, “if you are looking for a serious achievable policy, this is the best one we've got.”⁶

Taking stock of the EU ETS as it prepares to enter its third phase, this report identifies six key results of the EU ETS, highlights the lessons learned from these outcomes, and provides recommendations for jurisdictions developing their own climate policies. Other regions, states, and local jurisdictions looking to decouple greenhouse gas emissions from economic growth using cap-and-trade systems should consider the refinements implemented over the course of the EU ETS's development.

Results, lessons learned, and recommendations

1. The EU ETS has achieved immediate and significant emission reductions at minimal cost.

Independent studies at the regional, national, and firm levels have confirmed that the EU ETS has been a significant contributor to the reduction in European emissions, independent of the effects of the 2009 recession.⁷ Despite the modest ambitions of the EU ETS Phase I (2005–2007), the data suggest that from 2005 through 2007, the ETS reduced carbon emissions by 120 million to 300 million metric tons, or roughly 2–5% below the “business-as-usual” scenario.⁸ Phase II coincided with the global economic recession but introduced tighter emissions targets and achieved additional reductions of approximately 340 million metric tons in its first two years (2008–2009), or roughly 8% below projected business-as-usual emissions.⁹

Overall, from 2005 to 2009, these estimates indicate that the ETS was responsible for reductions of more than 480 million tons of carbon dioxide (CO₂), which is greater than the entire 2009 CO₂ emissions of Mexico or Australia.¹⁰ And while the economic recession has hit some European member states particularly hard, the ETS has succeeded in helping to decouple emissions growth from economic growth even in those European countries where growth has continued.¹¹

These emission reductions have come at relatively low cost.¹² No negative effects on the overall economy are evident, and even the effects on energy-intensive sectors such as power, steel, and pulp-and-paper have been minimal.¹³ By design, cap-and-trade programs like the EU ETS ensure that emission reduction objectives will be met at the lowest cost.

RECOMMENDATION Jurisdictions that wish to decouple emissions growth from economic development should emulate the successful design of and improvements to the EU ETS, which achieved significant reductions in emissions at low cost, even in its trial phase.

RECOMMENDATION Cap-and-trade critiques based on projected negative macroeconomic effects must be closely scrutinized in light of real-world evidence to the contrary. In designing cap-and-trade programs, policymakers can stimulate long-term emission reduction investments by maintaining a predictably declining, enforceable, science-based cap on carbon, even

when a recession leads to increased allowance supply or a growth spurt leads to increased allowance demand. The science of verified emissions, not the price of allowances, should drive the decision on the allowable amount of emissions, and thus the size of the cap.

RECOMMENDATION Economic policymakers who wish to capitalize on the growing low-carbon sector should focus on the environmental integrity and enforceability of the emissions cap, which in turn will unleash the proven effectiveness of cap-and-trade in stimulating the deployment of low-carbon innovation.

2. Over-allocation of allowances occurred during the ETS Phase I, and allowance prices consequently dropped sharply, but the policy stability provided by enactment of Phase II targets led firms to make durable investments in reducing emissions and deploying low-carbon strategies.

When developing the pilot phase of the ETS, which ran from 2005 to 2007, the EU lacked reliable data on industry-wide and company-specific emissions for prior years. So it allowed its member states to allocate allowances to entities based on the entities' own estimates of their emissions, rather than on verified data of actual historical emissions. Each member state applied different rules for national allowance allocations, and some issued allowances based on the entities' own optimistic growth forecasts.¹⁴ Entities were required to provide detailed data on actual emissions only during the pilot phase, not before. In April 2006, midway through the second year of the pilot phase, when the prior year's reports on actual emissions were published, it became obvious that member states had allocated too many allowances—almost 4% too many, by some estimates.¹⁵ Allowance prices correspondingly dropped dramatically, as demand and perceived supply rebalanced themselves.

Later in the pilot phase, allowance prices actually dropped to zero. Why? Phase I was a trial period, but in theory, the EU could have designed its system so that surplus pilot phase allowances could be banked or saved for use in the next phase, from 2008 to 2012. The EU chose not to do so, however, because it had separately undertaken an international treaty obligation to limit EU-wide emissions to 8% below 1990 levels for 2008-2012; the ETS was one of the main policy tools that the EU sought to use to meet that obligation. Authorizing ETS pilot phase allowances to be banked for use in offsetting emissions increases during Phase II would have made it more difficult for the EU to comply with its international obligation, which pertained only to the 2008-2012 period and did not recognize reductions earned before 2008. When entities found that they could comply fully with the pilot phase obligations without using all their (over-allocated) pilot phase allowances, the price of the remaining allowances, which could not be used in the next phase, predictably fell to zero as the end of the trial period approached.

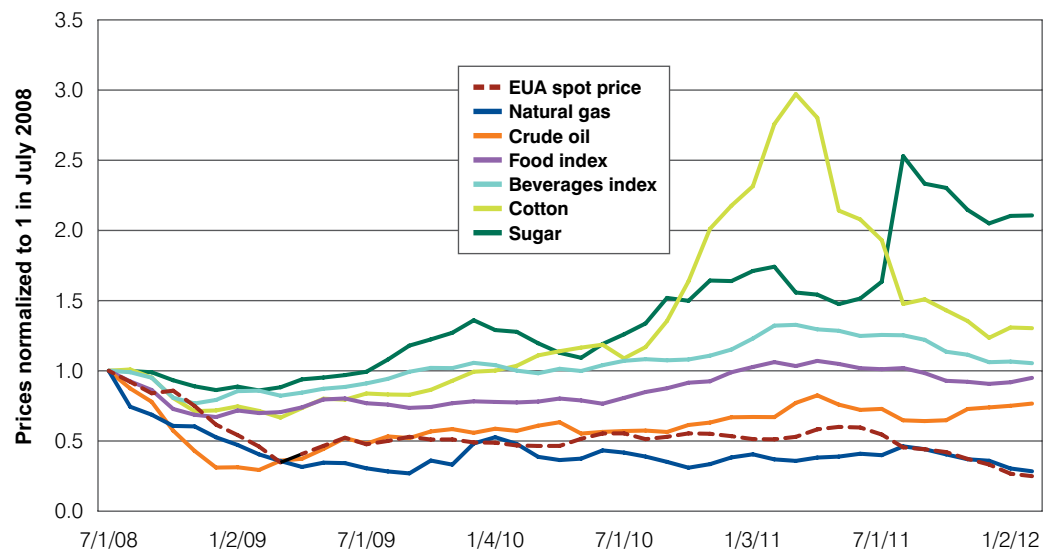
Nonetheless, since the inception of the program, EU allowance (EUA) prices have been less volatile than many other traded commodities (see Figure ES.1, next page). Even during Phase I, futures contracts for bankable permits that could be used in Phase II and III maintained relatively stable prices.

This market certainty fostered the investment and economic development that are the central long-term benefits of cap-and-trade programs; despite initial over-allocation and sometimes dramatic allowance price decline, the cap on carbon drove and is continuing to drive investments and innovation in carbon abatement, as indicated by the decline in overall emissions above and beyond those attributable to the recession, and by process and technological changes in the power sector.¹⁶

RECOMMENDATION Emissions caps and resulting allowance allocations should be based on measured and verified historical emissions, rather than on estimated or projected emissions.

FIGURE ES.1

Comparing the price volatility of European Union Allowances (EUAs) with various commodities, 2008–2012



Source: All commodities indexed relative to their value in July 2008. Source: EUA spot price data from Point Carbon. Other commodity data accessed from IMF Commodity Price Index, available at www.imf.org/external/np/res/commod/index.aspx.

Collecting reliable and accurate pre- and post-program data on emissions and economic activity as part of any emissions trading system is important not only to create incentives to reduce emissions, but also to establish a sound basis to construct business-as-usual scenarios needed to evaluate and verify a program’s success.

RECOMMENDATION To smooth price volatility and to encourage durable, early investment in reducing global warming pollution, carbon market regulators should provide a predictable long-term policy environment that allows banking of allowances between trading periods. As long as an ambitious emissions cap is in place and reductions are being achieved, reductions achieved at low market prices for emissions allowances should not be regarded as a market “failure”; rather, low market prices for emissions allowances may indicate that firms are achieving emission reductions at lower costs than predicted. Efficient reductions allow society to achieve more ambitious targets at lower cost, freeing up capital resources for other useful purposes.

3. Windfall profits occurred in some member states but can be avoided using a variety of policy tools.

Some European companies earned windfall profits by passing through to consumers the price of allowances that they received for free. The problem, however, was largely concentrated in a few countries and occurred primarily in the electricity sector. The countries most affected were those with high-carbon sources of peak electricity and weak regulation of electricity prices, so that utilities were allowed to bill their customers for the “opportunity costs” of not selling emissions allowances that the utilities had in fact received for free.

RECOMMENDATION The most effective means of reducing or eliminating windfall profits are the auctioning of allowances and regulatory oversight of public utilities.

4. Reforms have improved elements of the EU ETS that allow emitters to tender credits earned from projects that reduce emissions in developing countries (“offsets”), but further reforms would be useful.

When the EU first developed the ETS, it decided to give regulated entities the flexibility to use not only emissions allowance trading to meet their emissions limits, but also, within certain quantitative limits, credits earned by projects that reduce emissions in developing countries. These credits could be tendered to offset emissions above a company’s limits as long as the emission reductions achieved were certified through the Kyoto Protocol’s Clean Development Mechanism (CDM) to be below what would have otherwise occurred. Certified Emission Reduction units (CERs), have been controversial because some have questionable “additionality,” meaning it is difficult to prove that the emission reductions would not have occurred without the project. Further, by awarding emissions offsets for project-based reductions from business-as-usual emissions in industrializing nations without emissions caps, such as China and India, the CDM implicitly rewards developing countries for staying out of a global emissions cap-and-trade system.¹⁷

RECOMMENDATION Offset programs should have rigorous monitoring and accounting methodologies that clarify whether emission reductions are “additional” (i.e., below a credible baseline). Further, cap-and-trade programs should adopt reforms that allow offset credits only from jurisdictions that have capped some portion of their emissions, or—as the EU will begin requiring in 2013 for new projects—only from least-developed countries. To the extent that cap-and-trade programs wish to link their emissions trading programs to other nations’ programs, they should do so preferentially with nations that adopt caps or limits on major emitting sectors, which may include limits aimed at reducing emissions from deforestation and forest degradation.

5. The ETS has made significant progress in preventing tax fraud and theft of allowances.

In January 2011, thieves stole approximately \$67 million (€50 million) of EU allowances from some member states’ carbon registries. While the sums stolen were not trivial, their scale in light of the annual value of the EU emissions allowance system was small—approximately 0.06%. For comparison, annual credit card fraud in the United States is 50% higher as a fraction of total value, estimated at roughly 0.09% of annual transaction value.¹⁸ EU governments lost much greater revenues from large-scale fraudulent value-added tax transactions on sales of emissions allowances, but these resulted from a lack of harmonized EU tax structure, not from the design of the ETS itself.¹⁹

Fraud is not limited to the EU ETS. It occurs in many different markets. Markets for products that can be quickly traded internationally in transactions that are subject to national value-added tax (VAT) systems seem to be particularly vulnerable.²⁰ These fraud events have, however, highlighted a specific problem for the EU ETS: the lack of oversight of market participants.

The European Commission has tackled the challenge of oversight with recent registry reforms. Together with active steps by member states to address VAT fraud, the Commission’s reforms have put in place the security necessary for the long-term integrity of the EU ETS, making significant future losses unlikely.

RECOMMENDATION Cap-and-trade regulators and market participants must establish effective governance and regulatory bodies, as well as preventive electronic security systems, that can adapt to evolving cyber attacks and other market security threats.

6. Companies and entrepreneurs have responded to the ETS and its complementary policies with a diverse range of profitable investments in low-carbon solutions.

Case studies, some of which are highlighted in Appendix A, demonstrate the innovative, entrepreneurial responses of firms and individuals to the EU ETS and its complementary energy and environmental policies in Europe.²¹ For instance, an analysis by the German government indicates that renewable energy in Germany employs more than 367,000 people, providing 70,000 to 90,000 more jobs than a scenario in which fossil fuels provide the same growth in energy use.²²

The EU's emissions trading infrastructure has evolved along with the ETS. In the EU there is now a diverse set of institutions and individuals with the knowledge and experience needed to accurately count and report emissions and invest in emission reductions. The ETS is persuading market actors to include the value of emission reductions in their operational decision-making and long-term investment planning.

RECOMMENDATION Countries, states, and other jurisdictions that wish to stimulate low-carbon innovation and encourage business to think creatively about reducing greenhouse gas emissions should institute an ambitious cap-and-trade system.

Going forward

Evolving and improving over time, the EU ETS is already working to reduce emissions and decarbonize the EU economy. Perhaps the most important lesson of the EU ETS is the benefit of starting cap-and-trade programs early, even if the initial design is not ideal. The design flaws and weaknesses of various policy tools are often difficult to anticipate, making practical experience a much-needed litmus test. What is important is evaluating results, making needed changes, and increasing policy ambition over time.

After a three-year trial period and almost five years of full operation, the EU ETS provides an example of an increasingly sophisticated and successful multinational emission reduction system. As the world's first large-scale CO₂ cap-and-trade system, the ETS offers a unique opportunity for other regions, nations, states, and even local jurisdictions that are considering carbon-trading systems to learn from its experience and continue to build on its success.

Notes

- ¹ See A. Denny Ellerman, Frank Convery, and Christian de Perthuis, *Pricing Carbon*, Cambridge Press (2010), at 191. See also European Commission, "Climate change: Progress report shows EU on track to meet or over-achieve Kyoto emissions target," press release, Brussels, November 12, 2009, available at europa.eu/rapid/pressReleasesAction.do?reference=IP/09/1703&format=HTML&aged=0&language=EN&guiLanguage=en.
- ² See Karoline S. Roggea & Volker H. Hoffmann, "The impact of the EU ETS on the sectoral innovation system for power generation technologies—Findings for Germany," 38 *Energy Policy* 7639 (2010) (finding that "the EU ETS seems to have accelerated the innovation process in general"). See also Raphael Calel and Antoine Dechezlepretre, "Low CO₂ innovation is up, but not because of the EU ETS," LSE, May 1, 2012 (indicating that the EU ETS has spurred operational innovations, rather than technological changes), available at lse.ac.uk/GranthamInstitute/Media/Commentary/2012/May/Low-carbon-innovation-EU-Emissions-Trading-Scheme.aspx.
- ³ Ellerman et al., *Pricing Carbon*, *supra* note 1, at 243. See "Europe's emissions trading forum has 'tiny' impact as companies prepare for auctions," *ClimateWire*, December 9, 2010, available at eenews.net/public/climatewire/2010/12/09/1. See also McKinsey and Company & Ecofys, "EU ETS Review: Report on International Competitiveness," European Commission, December 2006, available at origin.mckinsey.com/client/service/sustainability/pdf/Report_on_International_Competitiveness.pdf; Julia Renaud, "Industrial Competitiveness under the European Union ETS," International Energy Agency, December 2004, available at 194.245.121.74/fileadmin/gruppen/bdz/Themen/Umwelt/IEA-Studie_11-2004.pdf.
- ⁴ Unless otherwise specified, in this report the term "emissions allowance" means an allowance issued under the directives establishing the EU ETS, to emit one metric ton of carbon dioxide equivalent during a specified period. Under the directives, emitters are required to tender to governmental authorities one allowance for each ton of actual emissions, and allowances are transferable. Some commentators also use the terms "permits" and "quotas" to refer more generally to these types of allowances, and on occasion we use these terms as well. The full text of the directives establishing the EU ETS's Phase I and Phase II, linking the ETS to project-based mechanisms, expanding the ETS to cover aviation, and extending

- the ETS to Phase III, can be found, respectively, at: Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC, L 275/32 EN Official Journal of the European Union (October 25, 2003); Directive 2004/101/EC of the European Parliament and of the Council of 27 October 2004 amending Directive 2003/87/EC establishing a scheme for greenhouse gas emission allowance trading within the Community, in respect of the Kyoto Protocol's project mechanisms, L 338/18 EN Official Journal of the European Union (November 13, 2004); Directive 2008/101/EC of the European Parliament and of the Council of 19 November 2008 amending Directive 2003/87/EC so as to include aviation activities in the scheme for greenhouse gas emission allowance trading within the Community, L 8/3 EN Official Journal of the European Union (January 13, 2009); and Directive 2009/29/EC of the European Parliament and of the Council of 23 April 2009 amending Directive 2003/87/EC so as to improve and extend the greenhouse gas emission allowance trading scheme of the Community, L 140/63 EN Official Journal of the European Union (June 5, 2009).
- ⁵ "Emissions impossible for CBI to stomach," *The Guardian*, March 20, 2004, available at guardian.co.uk/business/2004/mar/21/theobserver.observerbusiness10 ("industry ... issuing dire warnings to consumers. Households could face rises of 50 percent or more on their utility bills...").
- ⁶ Ben Schiller, "Europe's CO₂ Trading Scheme: Is it Time for a Major Overhaul?" *Yale Environment* 360, April 28, 2011 (quoting Michael Buick, Acting Director of Sandbag) available at e360.yale.edu/feature/europes_co2_trading_scheme_is_it_time_for_a_major_overhaul/2396/.
- ⁷ For a review of several of these studies, see Christian Egenhofer, Monica Alessi, Anton Georgiev, and Noriko Fujiwara, "The EU Emissions Trading System and Climate Policy towards 2050: Real incentives to reduce emissions and drive innovation?" CEPS Special Report, January 2011, available at papers.ssrn.com/sol3/papers.cfm?abstract_id=1756736&. See also "Emissions from the EU ETS down 3% in 2008," *New Carbon Finance*, February 16, 2009, press release, available at bnf.com/Downloads/pressreleases/38/pdf/11; Frank Watson, "EC CO₂ data shows that EU carbon trading is working: analysts," *Platts*, April 11, 2011, available at platts.com/NewsFeature/2011/emissionsdata/index; Ellerman et al., *Pricing Carbon*, *supra* note 1, at 191; Jan Abrell, Anta Ndoye Faye, and Georg Zachmann, "Assessing the impact of the EU ETS using firm level data," July 15 2011, at 9, available at bruegel.org/publications/publication-detail/publication/579-assessing-the-impact-of-the-eu-ets-using-firm-level-data/.
- ⁸ Ellerman et al., *Pricing Carbon*, *supra* note 1, at 191.
- ⁹ See A. Denny Ellerman, European University Institute, "The EU ETS: Path to the Future or Dead-end?" Presentation, September 5, 2011, available at dors.dk/graphics/Synkron-library/Konference%202011/Abstracts/Ellerman.pdf.
- ¹⁰ See Simon Rogers and Lisa Evans, "World carbon dioxide emissions data by country: China speeds ahead of the rest," *The Guardian*, January 31, 2011, available at guardian.co.uk/news/datablog/2011/jan/31/world-carbon-dioxide-emissions-country-data-co2. See also World Resources Institute, "Climate Analysis Indicators Tool (CAIT)," available at wri.org/project/cait/.
- ¹¹ Germany, Sweden, Poland, and Austria are among several EU ETS member states where economic growth has continued despite the economic recession. See Eurostat, "Real GDP growth rate-volume," available at <http://epp.eurostat.ec.europa.eu/tgm/table.do?tab=table&plugin=1&language=en&pcode=tec00115> (select Germany, Sweden, Poland, and Austria; then select "vertical bar graph" to display GDP growth in relevant years).
- ¹² See *ClimateWire*, *supra* note 3. See also Abrell et al., *supra* note 7, at 2.
- ¹³ See McKinsey & Company and Ecofys, *supra* note 3. See also Renaud, *supra* note 3.
- ¹⁴ See Barry Anderson and Corrado Di Maria, "Abatement and Allocation in the Pilot Phase of the EU ETS," 48 *Environmental and Resource Economics* 83, 86 (2011) ("Most governments allocated EUAs relative to ex ante BAU projections, with past emissions strongly influencing the more detailed distribution of allowances ... [causing] a direct incentive to inflate actual emissions"), available at springerlink.com/content/4724437n37562rw1/fulltext.pdf?MUD=MP.
- ¹⁵ Joseph E. Aldy and Robert N. Stavins, "The Promise and Problems of Pricing Carbon: Theory and Experience," *The Journal of Environment & Development*, October 2011, at 11, available at <http://www.nber.org/papers/w17569>.
- ¹⁶ See Roggea and Hoffmann, *supra* note 2 (finding that the EU ETS has been particularly important in stimulating research and development in the coal-fired power sector).
- ¹⁷ For a discussion of an alternative that would discount CDM credits earned from projects in advanced developing countries, see Kyle Meng and Jos Cozijnsen, "Viewpoint: Value-added CDM could stimulate more global reductions," CDM & JI Monitor, Point Carbon, September 5, 2007. See also Environmental Defense Fund, "Reforming the CDM: The Need for New Ways to Welcome Developing Countries into a Global Carbon Market," August 20, 2008, available at edf.org/sites/default/files/8303_CDMfinal_Ghana.pdf.
- ¹⁸ In 2006, U.S. fraud loss on credit and debit card payments amounted to \$3.72 billion. The total fraud loss rate on debit and credit card payments (per \$100) was \$0.092. Richard J. Sullivan, Federal Reserve Bank of Kansas City, "The Changing Nature of U.S. Card Payment Fraud: Issues for Industry and Public Policy," presentation at Harvard University, May 21, 2010, at 11, available at weis2010.econinfosec.org/papers/panel/weis2010_sullivan.pdf.
- ¹⁹ Estimates of uncollected tax revenue lost to VAT fraud on EU ETS allowances range as high as \$7.6 billion (€5 billion), but such estimates are disputed. See Alexandre Kossoy and Philippe Ambrosi, "State and Trends of the Carbon Market 2010," World Bank, Washington DC, May 2010, at 10, available at siteresources.worldbank.org/INTCARBONFINANCE/Resources/State_and_Trends_of_the_Carbon_Market_2010_low_res.pdf.
- ²⁰ See Oliver Sartor, "Closing the Door to Fraud in the EU ETS," *Climate Brief* No. 4, CDC Climat Research, February 2011, available at cdclimat.com/IMG/pdf/11-02_climate_brief_4_-_closing_the_door_to_fraud_in_the_eu_ets.pdf.
- ²¹ See also Ellerman et al., *Pricing Carbon*, *supra* note 1, at 185–191 (providing examples of individual company actions to reduce emissions in response to the EU ETS); Abrell et al., *supra* note 7 (finding that the tightening of the EU ETS cap and of allocations to installations spurred significant emission reductions within individual firms, after controlling for production changes due to the global financial crisis).
- ²² German Federal Environmental Ministry, "Renewably employed: Short and long-term impacts of the expansion of renewable energy on the German labour market," September 2010, at 8–9, 11, available at http://germany.info/contentblob/3179136/Daten/1346894/BMU_RenewablyEmployed_DD.pdf.



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