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The European Union Emissions Trading System

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The European Union Emissions Trading System

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The E.U. Emissions Trading System (E.U. ETS) is the world's first and largest greenhouse gas (GHG) cap-and-trade program. Currently responsible for 40 percent of all GHG emissions in the European Union, the E.U. ETS covers some 11,500 facilities owned by 5,000 companies in 30 countries (European Communities 2009; Aldy and Stavins 2011). By establishing the E.U. ETS, the European Union accepted the difficult task of creating the first multinational cap-and-trade program—even when major trading partners refused to participate. Now, the E.U. ETS serves as a prototype for a global climate regime.

I. Background

The E.U. ETS is designed to aid the European Union in achieving its Kyoto Protocol commitment to reduce GHG emissions by 8 percent below 1990 levels by 2012. The European Union negotiated its Kyoto commitment as a regional target, but built a burden-sharing agreement that assigned each member state its portion of the region's Kyoto commitment (Environmental Defense Fund – International Emissions Trading Association [EDF-IETA] 2012). The E.U. ETS is being implemented in three phases: a pilot phase (2005–2007), a five-year commitment period (2008–2012), and an eight-year commitment period (2013–2020).¹The

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This backgrounder is one in a series prepared for the project “Planning for the Ex Post Analysis of U.S. Climate Policy” to inform discussions and assessments of U.S. climate policy. The backgrounders summarize research on the following topics: (i) competitiveness impacts of climate policy; (ii) climate policy, international trade, and emissions leakage; (iii) Kyoto flexibility mechanisms: the Clean Development Mechanism and joint implementation; (iv) land use, land-use change, and forestry; (v) EU Emissions Trading System, and (vi) the U.S. Environmental Protection Agency's Acid Rain Program. Taken together, these backgrounders summarize research on several key aspects of climate policy. In addition to helping inform discussions and assessments of climate policy, the backgrounders are intended to provide informative overviews of each topic to anybody interested in conducting or better understanding climate policy assessment, including researchers, students, and experts in academia, government, nongovernmental organizations, and industry. Funding for this project has been provided by the Alfred P. Sloan Foundation. The authors thank Dallas Burtraw for comments and suggestions on this backgrounder.

¹ European Union, 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 Emissions Allowance Trading Scheme of the Community: lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32009L0029:EN:NOT (accessed November 9, 2012).

pilot phase, which was not part of the Kyoto Protocol, was intended “to establish the infrastructure and institutions and to gain the experience to make the subsequent ‘real’ periods a success,” as opposed to achieving significant emissions reductions (Ellerman et al. 2010, 34).

Despite its reliance on the E.U. ETS, the European Union is also increasing the stringency of complementary measures. In recent years, policies promoting energy efficiency and renewable energy have been particularly emphasized, as reflected by the European Union’s “20-20-20” directive. This directive aims to reduce carbon emissions 20 percent from 1990 levels, increase the share of electricity from renewables to 20 percent, and cut energy consumption through improved energy efficiency by 20 percent by 2020.² Moreover, the carbon emissions target of this goal is subject to change. Specifically, if a substantive international climate agreement is finalized, the European Commission (EC) might adopt a more stringent overall emissions target of 30 percent below 2005 levels for the European Union. In this case, the E.U. ETS cap could be lowered to an estimated 34 percent below 2005 levels (EDF-IETA 2012).

Because the E.U. ETS is an adaptive program—designed to change in response to lessons learned and new information—many key aspects have changed between phases. These key aspects include coverage, allowance allocation, auctioning, banking, and the use of offsets.

A. Coverage

The geographic, industrial, and GHG coverage of the E.U. ETS has changed with transitions between phases. In the pilot phase, the E.U. ETS covered the carbon dioxide (CO₂) emissions of 25 European countries³ and encompassed four sectors: iron and steel, mineral industries, energy production, and pulp and paper production. The E.U. ETS covered all facilities with a thermal input of 20 megawatts or greater (Ellerman and Joskow 2008). By covering these facilities, the E.U. ETS accounted for about 46 percent of all GHG emissions in the European Union (Kruger et al. 2007). The first commitment period expanded the E.U. ETS by adding two E.U. countries, Bulgaria and Romania, and three non-E.U. countries—Norway, Iceland, and

² European Union, Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the Promotion of the Use of Energy from Renewable Sources and Amending and Subsequently Repealing Directives 2001/77/EC and 2003/30/EC: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32009L0028:EN:NOT> (accessed November 9, 2012).

³ These countries include Austria, Belgium, Cyprus, Czech Republic, Germany, Denmark, Estonia, Spain, Finland, France, Greece, Hungary, Ireland, Italy, Lithuania, Luxemburg, Latvia, the Netherlands, Poland, Portugal, Romania, Sweden, Slovenia, Slovakia, and the United Kingdom.

Liechtenstein—as well as nitrous oxide emissions from the production of nitric acid (EDF-IETA 2012, European Communities 2009). At the beginning of the second commitment period, the E.U. ETS is expected to expand to include the aviation sector; additional GHGs; and the capture, transport, and geological storage of CO₂ emissions (European Communities 2009).

B. Country-Level Allowance Allocation, Monitoring, Reporting, and Verification

For the pilot phase and first commitment period, the overall quantity of allowances was determined through a decentralized, state-level process. In this process, each member state proposed a national allocation plan (NAP) that specified (a) that state's emissions target for ETS and non-ETS sectors and (b) how the state would allocate permits (Kruger et al. 2007). The EC subsequently reviewed each NAP to ensure scarcity of permits. However, the member states were fully responsible for deciding (a) how emissions were to be monitored, reported, and verified and (b) certain structural issues, including the portion of allowances to be auctioned (Kruger et al. 2007). Such a high degree of decentralization effectively meant that each state had its own cap-and-trade program, with each program linked to the others (Ellerman et al. 2010).

For the second commitment period, a single E.U.-wide emissions cap will replace the current system of 27 national caps implemented through NAPs. Auctions will be held by national governments, but buyers from any country will be able to participate (EDF-IETA 2012). This international cap will decline from the midpoint of 2008–2012 emissions levels at 1.74 percent annually, so that 2020 emissions levels are 21 percent below 2005 levels.⁴ In addition, the MRV of emissions will be harmonized across member states (European Communities 2009).

C. Auctioning and Revenue Use

The limit on how many permits can be auctioned has changed with each phase. Respectively, this limit has been 5 percent and 10 percent for the pilot phase and first commitment period. However, the EC has shifted the orientation of the second commitment period substantially. In this period, full auctioning of allowances for the power sector is expected from 2013 onward. For non-power sectors, free allocation in 2013 is set to 80 percent of 2005–

⁴ European Union, 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 Emissions Allowance Trading Scheme of the Community: lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32009L0029:EN:NOT (accessed November 9, 2012).

2007 emissions levels. It will decrease in equal amounts annually, with a goal of achieving 30 percent free allocation by 2020 and an ultimate goal of 100% free allocation by 2027. Industries deemed at risk for carbon leakage are exempted from this schedule of auctioned allowances and are set to receive up to 100 percent free allocation based on benchmarking. The EC states that this shift toward auctioning will ensure that the E.U. ETS operates with the highest possible degree of economic efficiency and will allow harmonization of allocation across member states. Moreover, the EC believes that auctioning will eliminate windfall profits and ensure fairness between new and existing entrants, as well as between countries experiencing fast and slow growth.⁵

In the second commitment period, allowances for auctioning will be distributed to member states based on historical emissions and income. Specifically, 88 percent will be distributed based on historical emissions, 10 percent will be based on wealth, and 2 percent will be based on admirable adherence in the pilot phase and first commitment period (EDF-IETA 2012). In turn, member states must invest at least 50 percent of auction revenues in one of the following: the European Union's energy efficiency and renewable energy goals, measures to reduce deforestation and increase reforestation and afforestation in developing countries, measures to increase forestry sequestration in the European Union, the environmentally safe capture and geological storage of CO₂, or efforts to cover administrative expenses in the management of the E.U. ETS.⁶

D. Banking

Facilities may choose to save, or *bank*, allowances from a given year and to use or sell them in a later year. However, allowances could not be banked for use in later phases during the pilot phase. That is, allowances in the pilot phase could be used for compliance only in that phase. For the second and third commitment periods, the EC allows unrestricted interperiod banking of emissions allowances (Ellerman and Joskow 2008).

⁵ European Union, 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 Emissions Allowance Trading Scheme of the Community: lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32009L0029:EN:NOT (accessed November 9, 2012).

⁶ European Union, 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 Emissions Allowance Trading Scheme of the Community: lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32009L0029:EN:NOT (accessed November 9, 2012).

E. Offsets

Starting with the first commitment period, the EC allows the use of offset credits—from developing countries via the Clean Development Mechanism or Annex B countries via Joint Implementation—for compliance, with two restrictions. First, each member country is obligated to achieve at least 50 percent of its emissions reductions domestically, without offsets. This provision was a supplementary condition of the Kyoto Protocol. Second, the use of offsets has been restricted by calculating a percentage of allocation to each installation—11 percent on average. In the second commitment period, the installations that used offsets to comply with less than 11 percent of their allocation in the first commitment period are allowed to use up to 11 percent, increasing the total amount of offsets that are available for compliance use (EDF-IETA 2012). In addition, certain offset projects—including those that destroy trifluoromethane and nitrous oxide—are banned from use after April 30, 2013 (Europa 2011).

II. Available Data

The EC, E.U. Environment Agency (E.U. EA), and individual E.U. countries collect data on emissions, compliance, and transactions. Although ease of use and data quality varies, much of the information collected by these organizations is available to the public. One notable exception is data on allowance prices, which must be purchased from private sector market analysts, and certain data on transactions. This section describes in detail the data available to researchers.

A. Community Independent Transaction Log

Facilities regulated by the E.U. ETS record a variety of data through the E.U. ETS Community Independent Transaction Log (CITL). The EC publishes some of these data yearly, whereas other data are published at the end of each phase or commitment period. The European Union uses the CITL to establish permit allocation, compliance, and transaction information for allowances and offsets. Some CITL data are private for proprietary reasons. However, the EC makes much of its CITL data publicly available through its online interface,⁷ which includes multiple databases that are queriable by year, country or facility. The following information is available:

⁷ European Commission, European Union Transaction Log:
<http://ec.europa.eu/environment/ets/welcome.do?languageCode=en>.

- facility registration
 - facility name
 - facility address
 - facility contact information
 - facility account status (open or closed)
 - allowances allocated at a facility level, by year and country
 - allowances surrendered at a facility level, by year and country
 - verified emissions at a facility level, by year and country
- yearly allocated emissions credits
 - total allowances allocated to countries, by phase or commitment period
- holding accounts
 - account type
 - account holder
 - installation name
- transaction
 - date of each transaction
 - transaction identification
 - transferring and acquiring party
 - type of credits

The CITL database has two main limitations. First, compiling data can take considerable effort because some data are tucked away in hyperlinks and are not easily exportable. Second, transaction data do not identify the volume or price of a transaction.

B. Aggregated Data from the Community Independent Transaction Log

The E.U. EA makes data on the E.U. ETS publicly available by aggregating the CITL database.⁸ In addition, the E.U. EA manages a data viewer⁹ that provides a primarily graphical user interface.

- allocations, emissions, and surrendered allowances by country, year, and sector
- surrendered offsets by country, year, and sector
- number of installations by country, year, and sector

The E.U. ETS CITL data may be useful for casual comparisons of the scale and scope of the E.U. ETS regulations. In addition to suffering the same limitations as the CITL database, the data may be too highly aggregated to be useful in research.

C. Country-Level Registries

Some countries participating in the E.U. ETS collect additional data at a country-level. The data contained in these registries differs by country, with varying degrees of quality and ease of use. For instance, Germany and the United Kingdom provide facility-level information, including installation type, management, facility contact name and number, and emissions compliance information by year. On the other hand, some countries—Italy, for example—do not have any publicly available reports. Other countries may not provide translations to English—Poland, for example—or links to registries may be broken.¹⁰ Most reports are available in PDF form only, requiring an exceptional effort for data collection. Therefore, although these registries may be useful for finding information regarding a specific facility, their value for research is limited. Unfortunately, uncertainty is bound to exist in the pilot phase and first commitment period because monitoring, reporting, and verification (MRV) of emissions is heterogeneous across member states. In the second commitment period, harmonization of MRV of emissions across member states might improve the value of country-level registries to researchers.

⁸ European Environment Agency, European Union Emissions Trading System (EU ETS) data from CITL: <http://www.eea.europa.eu/data-and-maps/data/european-union-emissions-trading-scheme-eu-ets-data-from-citl-4>.

⁹ European Environment Agency, E.U. Emissions Trading System Data Viewer: <http://dataservice.eea.europa.eu/PivotApp/pivot.aspx?pivotid=473>.

¹⁰ The links for the French, Latvian, Liechtenstein, and Romanian registries all appear to be broken.

D. Permit Prices

Perhaps the greatest challenge for research on the E.U. ETS is assembling accurate data for allowance and offset prices. Although the EC collects transaction-level data as part of the CITL, the EC does not collect price data to accompany this information. Emissions credits—in the form of European units of accord (EUAs), which are allowances allocated to regulated facilities by member states; certified emission reductions (CERs) from the Clean Development Mechanism; and emission reduction units (ERUs) from Joint Implementation—trade predominately on the European Climate Exchange (EXE) in London.¹¹ However, credits are also traded on the Nord Pool exchange in Oslo, Norway; the Powernext exchange in Paris, France; and the European Energy Exchange in Leipzig, Germany. These markets trade in both the spot market for emissions credits and the futures market. Assembling time series data on permit prices requires purchasing data from either Thomas Reuters Point Carbon,¹² or the Intercontinental Exchange (ICE).^{13,14} These data generally include spot and future prices, as well as exchange volumes.

III. Results

The E.U. ETS represents an unprecedented success of large-scale trading of GHGs and, importantly, sets an international precedent for climate action. However, the E.U. ETS is not flawless. Several researchers have attempted to assess the effectiveness of the E.U. ETS. In this section, several aspects of the E.U. ETS are broadly reviewed, including the emissions reductions achieved by the E.U. ETS; the overallocation of allowances by the E.U. ETS; and the evolution of MRV procedures under the E.U. ETS. For a more detailed review of key studies that assess the effectiveness of the E.U. ETS, see the competitiveness and leakage backgrounders.

¹¹ EXE represents approximately 80 percent of the volume of trade for EUAs, CERs, and ERUs.

¹² Thomson Reuters Point Carbon, Carbon Market Research:
<http://www.pointcarbon.com/research/promo/research/>.

¹³ Inter-continental Exchange, Emissions:
<https://www.theice.com/productguide/ProductGroupHierarchy.shtml?groupDetail=&group.groupId=19>.

¹⁴ As of 2007, ICE owns EXE.

A. Emissions Levels

By most accounts, the E.U. ETS has successfully reduced emissions. Ellerman and Buchner (2008) tentatively estimate that, in both 2005 and 2006, the E.U. ETS abated 85 million metric tons, or 4 percent of annual emissions. Grubb et al. (2009) estimate that the E.U. ETS resulted in a 2.5 to 5 percent reduction in emissions below baseline levels. As previously mentioned, cuts to the NAPs for member states participating in the 2008–2012 commitment period amount to an approximately 7 percent reduction in emissions compared to 2005 allocations (Betz and Sato 2006).

B. Overallocation of Allowances

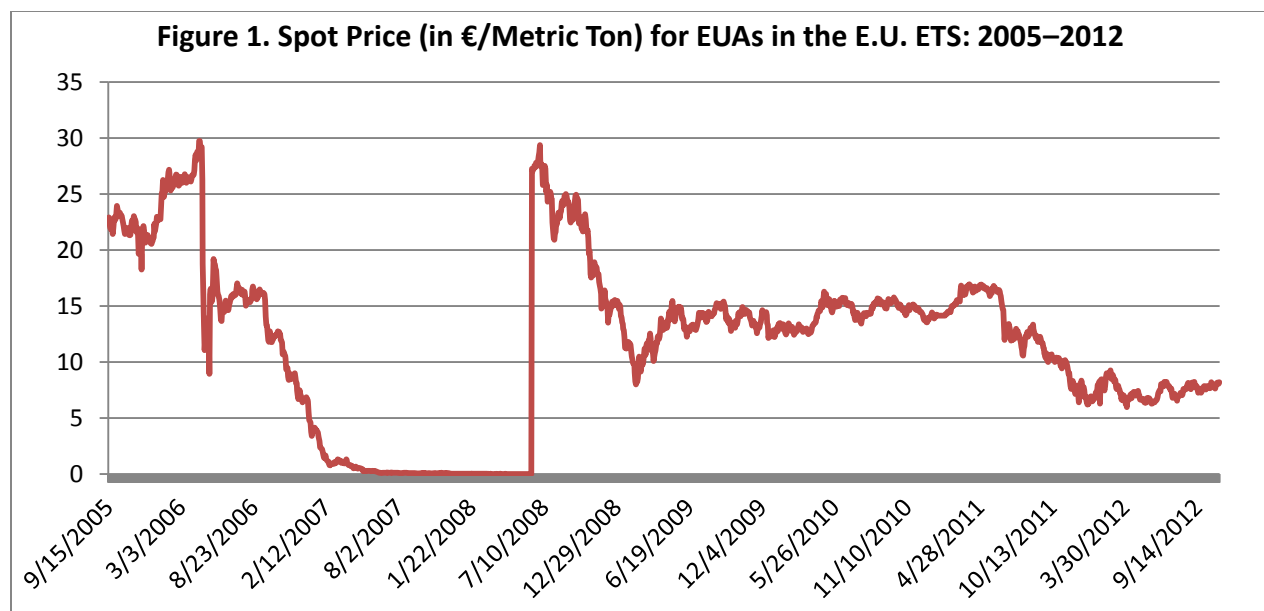
These reductions occurred in spite of significant allowance overallocation in the pilot phase and two drops in allowance prices linked to the economic recession and financial crisis. The causes of overallocation and drops in prices are discussed in this section.

Over-allocation occurred in the pilot phase for two main reasons. First, a general lack of experience may have caused countries to genuinely overestimate their business-as-usual GHG emissions paths. For example, emissions projection models for certain sectors were not available, so most initial projections were not as reliable as would have been preferred (Ellerman and Buchner 2007). Second, countries may have knowingly manipulated emissions projections by inflating them to attain more allowances (Betz and Sato 2006). The EC is tasked with ensuring scarcity and, in this capacity, acted to reduce the proposed allocation by approximately 100 million tons of CO₂ by revising 14 out of the 25 proposed NAPs. Overall, 2.15 billion allowances were distributed. This allowance haircut, however, was not enough to remedy the oversupply. Consequently, allowance spot prices effectively plummeted to €0 per metric ton for much of 2007 (Figure 1).

For the first commitment period, the total allocation of allowances was reduced approximately 7 percent compared to the pilot phase (Betz and Sato 2008). This reduction seemed to ensure a level of allowance scarcity, with prices over €20 per metric ton during the first half of 2008. The onset of the economic recession in late 2008 dropped spot allowance prices for allowances to €10–15 throughout most of 2011. In turn, the financial crisis dropped spot allowance prices further, to around €8 per metric ton, in 2012 (see Figure 1).

Looking ahead to the second commitment period, the EC is considering postponing the auctioning of some volume of allowances in 2013–2015 until toward the end of the second commitment period. This is an effort to ensure a level of scarcity, given the “growing surplus of

allowances built up over the last few years” (Europa 2012, 1). To this end, the EC has proposed an amendment allowing changes to the timing of auctions within a trading period that would enable the EC to execute a postponement (Europa 2012). In addition, the cancellation of some volume of allowances has been proposed (Morales 2012). Assuming the postponement of the auctioning of 800 million allowances and the cancellation of 600 million allowances, analysts predict allowance prices could reach €25 by 2020 (Thomson Reuters Point Carbon 2012).



Source: Figure created by RFF with data from Thomson Reuters Point Carbon.

C. Differences in Allowance Allocation

The member state’s ability to choose how allowances were distributed to domestic facilities had important implications for the pilot phase and first commitment period. This ability meant that facilities competing in the same markets but located in different countries might receive different allocations of allowances. “The resulting perception of unfairness and possible competitive advantage” has contributed to the EC’s revision of allocation and auction rules for the second commitment period (Ellerman et al. 2010, 34).

D. Monitoring, Reporting, and Verification Standards

The decision to freely allocate allowances to facilities based closely on expected business-as-usual emissions challenged member states because few had emissions data for these facilities. Although the U.N. Framework Convention on Climate Change had previously

collected CO₂ inventory data for each country, these data were based on fuel use aggregates that were not available at the facility level (Kruger et al. 2007). Ultimately, many member states had to rely on voluntary information from facilities. The relatively low compliance threshold of 20 megawatts for inclusion compounded this problem; 80 percent of facilities produced only 10 percent of all emissions, so relatively minor plants had to undergo significant efforts to report emissions (Ellerman and Buchner 2007). In response, during the pilot phase and the first commitment period, the E.U. ETS granted considerable latitude to member countries regarding MRV procedures. The EC established “tiers” of categories for monitoring technologies that are assumed to have differing degrees of accuracy. Each firm was assumed to use only top-tier methodologies; however, firms could petition to use a different methodology if it demonstrated that top-tier methodologies would be prohibitively expensive or impact their competitiveness. In addition, each member state had the authority to establish its own verification procedure and could elect to establish third-party verifiers if it is too costly to verify emissions data themselves. The result is that procedures were heterogeneous across countries, creating a level of inherent uncertainty as to whether a ton of emissions reduction in one country equals a ton of emissions reduction in another country. As previously discussed, the EC has recognized this and is planning to harmonize the MRV of emissions from the second commitment period on (European Communities 2009).

IV. Conclusion

The experience of the E.U. ETS offers many lessons learned and successes. This backgrounder gives an introduction to the E.U. ETS, including challenges surrounding allowance allocation and measuring, reporting, and verification. The impacts of the E.U. ETS on competitiveness and leakage are discussed in other backgrounders.

Although the E.U. ETS has been extensively researched, this backgrounder highlights at least two areas for further research. First, the E.U. ETS relies on administrative discretion—for example, the EC has cut NAPs and proposed to postpone the auction of allowances—to ensure scarcity of emissions allowances. This is an important contrast compared to cap-and-trade programs in the United States, like the Regional Greenhouse Gas Initiative (RGGI), that rely on rules like price floors in an effort to ensure scarcity of emissions allowances. These policy differences may cause hurdles in possible linkages between U.S. programs and the E.U. ETS and are worth further research. Second, research on the interactions between cap-and-trade systems, energy efficiency efforts, and renewable energy targets has been limited with some exceptions, including Hood (2011). Given the European Union’s emphasis on these complementary

policies—and similar policies in RGGI and California—there is a clear need for a stronger emphasis on research in this area.

Overall, the E.U. ETS proves that cap and trade is an effective instrument in reducing carbon emissions. As the E.U. ETS moves forward, maintaining scarcity of allowances is a chief priority.

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