European Union

The World's Carbon Markets: A Case Study Guide To Emissions Trading

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Brief History and Key Dates:

The EU Emissions Trading System (ETS) was the first multi-national installation-level cap-and-trade program that limits carbon dioxide (CO_2) emissions, as well as emissions of other greenhouse gases (GHGs). The 31 countries covered by the EU ETS account for 20% of global gross domestic product (GDP) and 17% of world energy-related CO_2.[1] The EU ETS was established by Directive of the European Parliament and the Council of the EU in October 2003. In 2004, the Directive was amended to include flexibility measures that linked the EU ETS to the international carbon market before the EU ETS market became active in 2005. A 2008 Directive stated that the EU ETS would cover CO_2 emissions from aviation beginning in 2012[2] though as discussed below the aviation provisions have been subsequently subjected to a stop-the-clock proviso.. A 2009 Directive established annual emissions reductions for a post-2012 phase of the EU ETS without a sunset clause, which means the scheme is set to continue beyond 2020.[3] The EU ETS's implementation is divided into phases; the first phase spans 2005-2007, the second 2008-12, the third 2013-20, and the fourth phase from 2021-2028. While the EU ETS regulations include continuing declining emissions caps beyond 2020 as an automatic default, the emissions reduction targets required to meet the EU's stated emissions reduction goal of 80-95% below 1990 levels by 2050 will not be reached by the current codification of the ETS.

Summary of Key Policy Features:

CAP/TARGET: The EU ***Kyoto Protocol (KP) commitment*** aimed to reduce economy-wide greenhouse gas (GHG) emissions to 8% below the 1990 level by 2012. As part of the EU's strategy to reach this target, firms covered by the EU ETS cap were to reduce their emissions 6.5% below 2005 levels.[4] The Phase II (Kyoto period) ETS emissions cap was 2,083 metric tons of carbon dioxide equivalent per year ($MtCO_2e$/year). However, excluding the countries and installations added in Phase II, the comparable ETS-wide cap would have been 1,909 $MtCO_2e$/year, 8% below the Phase I cap of 2,181 $MtCO_2e$/year.[5] All covered EU installations must submit EU allowances (EUAs) to meet cap compliance, with each EUA allowing a firm to emit one ton of carbon dioxide equivalent. While the EU15, which includes all EU member states as of 1997, is considered a single regional bubble under its Kyoto commitment, EU nations have built a burden sharing agreement that has assigned each member state a portion of the region's KP commitment.[6]

The EU economy-wide ***target for GHG emissions reductions by 2020*** is 20% below 1990 levels (or 13% below 2005 levels). Spearheading this effort, the EU ETS target for capped installations is 21% below 2005 levels by 2020. In 2020, ETS-covered installations will be allowed to emit an estimated maximum of 1,777 million $MtCo_2e$.[7] The 2009 Directive that established Phase III of the EU ETS includes provisions to adjust the stringency of the economy-

wide cap from -20% to -30% in the event that other developed countries commit themselves to comparable emission reductions.[8] The ***long term objective*** is to reduce domestic emissions 80-95% below 1990 levels by 2050, though this covers the entirety of European emissions and not just sectors covered under the EU ETS.[9] In January 2014 the European Commission proposed a climate/energy policy framework for for the period 2020-2030. It includes a new target for GHG emission reduction of 40 % by 2030 compared to 1990 levels. This proposal will need to go through the usual legislative process before being adopted and may be subject to modification. Further details are provided in a later section.

SCOPE/COVERAGE: The EU ETS covers around 50% of EU CO_2 emissions and ***43% of total EU GHG emissions.***[10] The EU ETS limits greenhouse gas emissions from approximately ***11,500 installations***, which are owned by ***5,000 companies*** in ***31 countries.***[11] Covered installations are grouped into the following ***sectors***: electricity generation (by far the largest emitting sector), oil refining, coke and steel, cement and lime, glass, bricks and ceramics, pulp and paper, and miscellaneous.[12] Installations below sector-specific ***thresholds*** can opt out of the program if they are covered by equivalent measures. For example, installations under the power generation sector fall under the EU ETS if they exceed 20 megawatt thermal (MWth) of total capacity, while the lime, glass, and mineral wool insulation industries have daily GHG emissions thresholds of 50tCO_2e/day, 20tCO_2e/day, and 20tCO_2e/day, respectively.[13] Covered **gases** include CO_2 and, for Phase III, industrial gases, such as perfluorocarbons (PFCs) from aluminum and N_2O from Nitric Acid.[14] The ***point of obligation*** is at the point of emissions.[15]

Implementation has been divided into ***four phases*** to date. ***Phase I*** (2005-2007) was designed as a learning-by-doing test aimed at getting the system started and ready for KP commitment years. The foremost goals of Phase I were to establish proper infrastructure for trading and to pilot later phases of the system. Phase I successfully established a price for carbon, trading in emissions allowances across the EU, and the necessary infrastructure for monitoring, reporting, and verifying emissions.[16] Nevertheless, the European Commission lacked accurate information about member states' actual GHG emissions. As a result, individual member states put forward national allocation plans (NAPs)[17], which specified the amount of allowances that each installation would receive each year and the amount of offsets that they were permitted to use to satisfy their compliance obligation during Phase I. Only a few member states created scarcity of allowances relative to demand. The majority of member states did not create the necessary scarcity of allowances, and this overallocation of allowances led to a sharp drop in the price of Phase I allowances in April 2006 when the lack of scarcity became apparent (see the "Allowance Distribution" and "Results" sections for more details).[18] Regardless, inter-phase banking was not permitted and therefore excess allowances had no value beyond Phase I. This prevented entities from holding on to allowances for use during a later phase, which further depressed prices during Phase I.

Phase II (2008-12) covered the five years of the KP first commitment period. The EC based its verification of the second round of NAPs on data revealed from Phase I, and it made sure that the aggregate quantity of allowances was below the 2005 level of verified emissions. The emissions information generated during the pilot phase was thus vital to the design of Phase II.[19] Five countries were also added to the program in Phase II: Bulgaria, Romania, Liechtenstein, Iceland, and Norway.[20]

For ***Phase III (2013-20)*** the starting point of the new cap for the covered sectors wascalculated from 2008-2012 median emissions, and this cap will linearly decrease by an annual rate of 1.74% to reach 21% below 2005 emissions levels in 2020.[21] The annual 1.74% cap decrease began in 2013; however, the extrapolated initial year, or base year, for this reduction rate is 2010, so the 2014 cap will be more than 5% below the 2010 cap, not 1.74%.[22] The third phase of the EU ETS included the following changes in design:

- A harmonized single EU-wide cap instead of national caps previously established by national allocation plans.[23]
- Harmonization of monitoring, reporting, and verification provisions

- Full auctioning of allowances for the power sector in most member states[24] starting in 2013 and progressively more auctioning for the remaining sectors. These remaining sectors will receive up to 80% (100% for sectors exposed to carbon leakage[25]) of the required allowances for free, based on a sector-specific carbon intensity benchmark. Free allocation decreases to 30% by 2020.[26] With the exception of the manufacturing industry and power sector in certain member states, auctioning is the default method for allocating allowances within the EU ETS after 2012.[27]
- The use of certified emissions reduction units (CERs) and emission reduction units (ERUs) is harmonized across periods—covered entities are allowed to use ERUs and CERs for a portion of their compliance obligation in Phase III (quantities are limited and depend on the type of installation to receive international credits, and the number of international credits that were already used during Phase II of the EU ETS). During Phase II, European member states allowed the aggregate use of around 1,400 million tCO_2e in CERs and ERUs. The use of CERs and ERUs has been allowed in each individual member state and calculated as a percentage of the allocation to each installation.[28] Installations that were previously not allowed to use these offset credits for compliance during 2008-2012 are now allowed to use up to 11% until 2020. As a result, the total amount of available credits from ERUs and CERs increased to just above 1,600 million tCO_2e, which equates to approximately 50% of projected abatement required by the EU ETS, for 2008-2020.[29] Furthermore, after 2012 valid CERs must be sourced from Least Developed Country's (LDCs), meaning the CERs from China and India will not be allowed in the EU ETS. Phase III CERs may not derive from industrial gas projects,[30] and the acceptance in the EU ETS of credits from Clean Development Mechanism (CDM) or Joint Implementation (JI) hydroelectric projects exceeding 20 MW of installed capacity is subject to certain conditions.[31]

Phase IV is set to run from 2021 to 2028. The rules affecting this Phase need to be established. On January 22, the European Commission put forward its ***Framework for 2020-2030*** on climate and energy, which contains many implications for the EU ETS.[32] The main messages from the Commission's proposed framework for establishing climate and energy policies post-2020 include the following:

- ***GHG reduction target*** of 43% for ETS covered sectors by 2030 (relative to 1990 emissions), and a target of 40% for the EU as a whole.
- Increase of the ***Linear Reduction Factor*** from the current level of 1.74% to 2.2% to attain a 43% GHG reduction for EU ETS covered sectors by 2030.
- No acceptance of ***international credits*** for compliance purposes from 2020 onwards.
- Establishment of a market stability reserve (MSR) with the aim of providing an automatic adjustment of the supply of auctioned allowances based on a pre-defined set of rules in order to increase the system's resilience to market shocks. In a nutshell, this reserve would permit allowances to be added to the auctions when surplus in the market falls below 400 million allowances, and would permit allowances to be removed from auctions, when the surplus exceeds 833 million allowances.

The inclusion of ***international aviation emissions*** under the EU ETS has been highly contentious. Under those provisions, adopted in 2008, all emissions from flights to, from and within the EU were covered beginning in January 2012.[33] After controversy arose in several forums, those provisions were amended to facilitate international negotiations on aviation in the International Civil Aviation Organization, a 191-nation body that operates under the aegis of the United Nations. Specifically, in April 2013 the EU enacted "stop the clock" provisions that postponed the deadline for the aviation industry to surrender 2012 allowances by a year, from April 2013 to April 2014; under the stop-the-clock provisions, both 2012 and 2013 allowances would automatically become due in April 2014 due (absent additional legislative changes). Subsequently, in September 2013, the International Civil Aviation Organization (ICAO)

formally agreed to develop, by 2016, a global market-based mechanism capping international aviation's carbon pollution at 2020 levels.[34] At the time of writing, European policymakers had not reached agreement regarding what (if any) further modifications to the EU ETS adopt in advance of the April 2014 deadline, though various proposals have been under active consideration.

The discussion of ***maritime emissions*** at the EU level is, to date, focused on Monitoring, Reporting and Verification (MRV) provisions. The EU Commission is interested in establishing a reliable system and clear rules for proper monitoring and verification of maritime transport emissions, which is the first step to future inclusion of the sector. In June 2013 the European Commission set out a strategy for progressively integrating maritime emissions into the EU's policy for reducing its domestic greenhouse gas emissions, i.e.:.

1. Monitoring, reporting and verification of CO2 emissions from large ships using EU ports;
2. Greenhouse gas reduction targets for the maritime transport sector;
3. Further measures, including MBMs, in the medium to long term.

This is a non-legislative Communication that sets out the overall direction that the European Commission is considering for inclusion of maritime emissions into the EU's GHG reduction policies. In addition, the Commission published a legislative proposal on MRV, which suggested to apply MRV provisions only to vessels from 5000GT (gross tonnage) and higher. The European Parliament and European Member States are currently considering this proposal.

AUCTION OVERVIEW: Since 2013, most of the power sector must purchase allowances fully through ***auctioning***[35]. Because the power sector makes up a high percentage of the total emissions covered by the EU ETS, it is projected that entities covered by the EU ETS will need to acquire over 50% of total EU ETS allowances via auctions. Non-power sectors must purchase 20% of allowances at auctions from 2013 onwards, and a progressively higher percentage of allowances will be auctioned over time. Auctioned allowances are estimated to gradually increase and could reach 100% auctioning by 2027.[36] By contrast, in Phase II, only 3% of allowances were set for auctioning.[37] In Phase III, allowances to be auctioned will be distributed to member states based on emissions histories; specifically, 88% will be distributed based on emissions history, 10% based on wealth, and 2% based on emissions reductions achieved prior to 2005.[38] One impact of this will be that countries with lower income will receive a greater amount relative to high-income member states. Auctions are conducted by national governments, but buyers are located worldwide. European Commission estimates from 2009 suggest that auctions could raise EUR 30-50 billion/year by 2020,[39] but more recent estimates are lower due to unexpectedly low allowance prices during the past few years.[40]

It is recommended that half of ***auction revenues*** fund complementary GHG reduction measures in the EU and developing countries. Such measures can include renewable energy investment and energy efficiency (to meet EU targets), adaptation, minimizing the economic impact on low to middle income households from higher electricity rates, reduced deforestation, and carbon capture and storage (CCS) projects.[41] There is a divergence within Member States on the extent to which auction revenues are used for climate protection (ranging from some Member States reinvesting their full auctioning revenues for complementary GHG reduction measures, to others who return the auctioning revenues to their Treasury).

ALLOWANCE DISTRIBUTION: During both the pilot phase and Phase II, allowances were primarily freely allocated. Although the EC allowed member states to ***auction*** a maximum of 5% of their cap during the pilot phase (up to 10% for Phase II), this option was rarely exercised.[42] For Phase I and II, ***free allocation*** implied that each member state developed and made public its own NAP that specified the amount of allowances that each installation would receive each year and the amount of offsets (within the scope of EU-wide provisions, as outlined in the

"Flexibility Mechanisms" section) that they were permitted to use to satisfy their compliance obligation. NAPs were submitted to and evaluated by the EC.[43]

In the short term, the EU expected to rely on fuel switching to significantly reduce its GHG emissions. The power sector's significant mitigation potential coupled with its ability to pass on the associated costs to end-consumers—including the industrial sectors covered under the EU ETS—contributed to the power sector receiving fewer free allowances relative to other sectors. The greater share of free allocation for non-power sectors was intended to compensate these sectors for the likely increase in electricity tariffs as a result of the ETS. This distribution of allowances generated more trading across sectors, adding liquidity to the market.[44]

During ***Phase I***, the EC established two main criteria for allocating free allowances: (1) consistency with member states' targets and their projected progress assessments, and (2) technological potential of abatement.[45] These criteria provided opportunities for "gaming" the process, which became evident after the fact. According to Aldy and Stavins (2012), the decentralized cap-setting process by member states, "created incentives for individual countries to try to be generous with their allowances to protect their economic competitiveness… Not surprisingly, the result was an aggregate cap that exceeded business as usual emissions."[46] Overallocation became less of an issue in ***Phase II***, but industrial sites in general, as well as some power producers, still received more allowances than their total emissions. Reduced output during the recession was a major reason for the overabundance of carbon credits. In ***Phase III***, auctions and uniform Europe-wide rules for free allocation determine allocations in order to reduce subjectivity and gaming potential.[47]

FLEXIBILITY PROVISIONS: As soon as the Directive regulating Phase III was finalized, unlimited ***banking*** in Phases II and III was allowed which linked these (and future) phases. This design feature is proving to be crucial in providing continuing incentives for abatement and maintaining relatively stable prices for EUAs, even though it appears the recession has contributed to an unexpectedly low demand for allowances.[48]

Offset usage for the period 2008-2020 is constrained collectively to 50% of the required aggregate abatement relative to 2005, and member states are allowed to use ***flexibility mechanisms established by the Kyoto Protocol***. These measures include the United Nations' Clean Development Mechanism (CDM) and Joint Implementation (JI), and they increase the diversity and availability of low cost compliance options within the EU ETS. Capped industries were not allowed to use ***CERs and ERUs*** to meet their compliance goals until Phase II. In Phase II, CERs and ERUs were allowed to comprise up to 13.4% of the total EU cap, which equates to 1.4 billion allowances in total.[49] For Phases I and II, countries individually specified the offset percentage allowed (domestic and international offsets together as a percent of total allowances) within their own countries; the range varied from 0% (Estonia) to 20% (Spain, Germany, and Lithuania).[50] Since the start of 2013, new projects generating CERs must be sourced from Least Developed Countries (LDCs). As a result, post-2012 CERs from China and India—countries that account for 68% of the global CDM market—are no longer allowed in the EU ETS.[51] In addition, post-2012 CERs may not derive from industrial gas projects,[52] and the acceptance of post-2012 ERUs and CERs from hydropower projects exceeding 20 MW of installed capacity is subject to certain conditions. [53] Based on current European Commission proposals yet to be confirmed, the EU may not accept any international credits into its market after 2020, unless comparable efforts for reducing emissions are in place in the main countries with which the EU trades.

Borrowing is not technically allowed, but the compliance period submission deadlines follow the issuance of the next year's allowances. Therefore, there is effectively year-ahead borrowing within trading periods (but not across the last year of one period to the first year of the next).[54]

The EU considers linkage of its carbon market with programs in other countries as an essential step in building a global carbon market.[55] Norway, Iceland, and Liechtenstein joined the EU ETS in 2008. The EU ETS is planning to establish a link with the Swiss ETS. The EU and Australia signed a linking agreement in September 2012, which

would provide a two-stage link. From 2015 onwards, Australian covered entities would be allowed to use EUAs to meet their obligations, and EU entities could use Australian allowances from July 1 2018 onwards. However, negotiations over this link have been put on hold until there is further clarity on the future of the Australian trading scheme.

COST CONTAINMENT / VOLATILITY MANAGEMENT: Banking between Phases II and III, and Phase III's longer eight-year trading period, are both intended to bolster investment certainty. In addition, the decline in the EU ETS linear cap persists beyond 2020 in order to provide a stable, long-term policy signal for investors.[56]

In response to low demand for allowances in the EU ETS, and subsequent low prices, the European Commission proposed ***'backloading'*** a number of allowances during Phase III. The proposed amendment to the ETS Directive adopted in February 2014 allows the withholding of 400 million allowances from auctioning in 2014, 300 million in 2015 and 200 million in 2016. These allowances will be auctioned at a later date: 300 million in 2019 and 600 million allowances in 2020.[88]

COMPETITIVENESS PROVISIONS: Under certain conditions, firms in sectors that are 'at risk' of carbon leakage may receive free allowance allocations based on industry best-practice benchmarking – measured as the best 10% of performers in the sector - but the total free allocation to benchmarked industries decreases linearly with the overall cap. Non-power sectors receive 80% of their benchmark for free, but this free allocation decreases to 30% in 2020 and 0% in 2027. Until 2020, ***emissions-intensive trade exposed (EITE)*** firms receive up to 100% of their benchmark via free distribution.[57]

MARKET REGULATION, COMPLIANCE, AND OVERSIGHT: Capped firms must have their emissions independently verified and are required to annually report on these emissions. Firms whose emissions are not independently verified are not allowed to sell allowances until an independent verifier approves their reports.[58]

Transaction ***registries*** track the ownership of allowances. Allowances are held in registries via electronic accounts, and the EU registry system is linked to the Kyoto national registry system. ***Electronic security*** has strengthened over the course of the ETS, especially in 2011. In January 2011, thieves stole approximately USD 65 million (EUR 50 million) of EU allowances from some member states' carbon registries.[59] When the thefts were discovered, the EU quickly shut down the registries and conducted an investigation. New registry regulations, which implemented a series of important reforms to improve regulatory oversight and market security, were adopted in November 2011.[60]

In Phase II, operators of any installation that has emitted GHGs in excess of submitted allowances are subject to a ***penalty*** of EUR 100/tCO_2e. In Phase I, this penalty was EUR 40/tCO_2e, and in Phase III this penalty increased with the EU consumer price index.[61] Companies that fail to comply with their respective caps also have their names publicly published. Member states have also established other penalties at the national level.[62]

COMPLEMENTARY AND SUPPLEMENTARY MEASURES: Individual member states and the EU have implemented a range of complementary domestic climate policies in addition to the EU ETS, including 20% targets in 2020 for ***energy efficiency*** and ***renewable energy***. Emissions from ***non-ETS sectors***, which comprise approximately 60% of EU GHG emissions, will decrease to 10% below 2005 levels by 2020.[63] The proposal included in the 2030 Framework foresees a 30% GHG reduction for non-ETS covered sectors by 2030 compared to 2005 levels.[89]

ECONOMIC PROJECTIONS: In September 2013, Thomson Reuters Point Carbon provided long-term price estimates for the EU ETS[64]. They project that there will be oversupply in the EU market until 2027, and that prices for EUAs will be below EUR 10/ton until 2022. By 2030, prices will reach approximately EUR 66/ton nominally (EUR 48/ton in 2013 prices). However, higher economic growth over this period would impact allowances significantly –

for example, a 1 percent rise in GDP growth per year relative to the base case will see EUA prices reach EUR 96/ton. Conversely, a 1 percent decrease in GDP growth per year compared to the base case will lead to EUA prices of EUR 21/ton in 2030.

These price forecasts will also depend on the extent to which the EU ETS will be reformed. The Commission has proposed creating a reserve, to tackle the structural surplus in the market. Should this reserve be created, there are expectations that the forecasted price for EUAs will increase.

RESULTS: In **Phase I**, the EU ETS reduced **emissions** by an estimated 2-5%,[65] and allowance ***prices*** were volatile. At the outset of Phase I, allowances were EUR 8/ton in January 2005. By early 2006, the price exceeded EUR 30/ton, only to fall back to EUR 8/ton by April 2006. According to Aldy and Stavins (2012), "This volatility was attributed to the absence of transparent, precise emissions data at the beginning of the program, a surplus of allowances, energy price volatility, and a program feature that prevents banking of allowances from the first phase to the second."[66] In ***Phase II***, ***emissions*** were on track to be below the cap. Phase II ***allowance prices*** began relatively high; they rose to above EUR 20/ton in the first half of 2008, and they averaged EUR 22/ton in the second half of that year. However, prices fell in the first half of 2009 when they reached EUR 13/ton only to further fall to EUR 10/ton by the fall of 2011. Aldy and Stavins (2012) primarily attribute this Phase II allowance price decline to the recession.[67] Another contributing factor to the price decline in Phase II is the slow pace of global climate policy developments, notably the failure of the US to enact federal cap-and-trade and of UNFCCC to reach a global climate change deal at Copenhagen.[68]

By far the biggest demand for CERs is in Europe, and, according to Sandbag (2010), CDM "is serving to reduce prices of compliance and delivering substantial volumes of finance (circa EUR 860 million per annum, [or about USD 1.1 billion/year]) to countries outside of Europe."[69] According to the European Commission (2009), the recognition of international offsets has triggered a ***substantial flow of investment and technology to developing countries***, expanding its impact beyond the borders of the EU.[70] Opinions on the integrity of UN CDM offsets vary amongst analysts of the program.

In its proposed 2030 Framework , the European Commission has indicated a change in policy direction, focusing primarily on domestic emission reductions in the EU rather than allowing the use of international credits in the EU ETS post-2020.

In its first and second phases, the EU ETS has ***learned from and overcome initial problems***, and has made carbon emission management a central part of business planning for EU energy and industrial sectors. The regulation has been tested and its weaknesses revealed and addressed. In sum, the program created the world's first multi-national, firm-level compliance carbon market, without measurably affecting EU competitiveness or constraining growth.[71]

What Distinguishes this Policy?

UNIQUE ASPECTS:

1. The EU ETS is the ***largest emissions trading system in the world***. Its coverage, scale, and market value far exceed other carbon markets currently in operation.
2. The EU ETS was the first ***multi-national*** installation-level cap-and-trade system that ***set up a market for CO_2 and other GHGs.***

CHALLENGES:

1. There is lack of clarity regarding how the EU ETS will continue ***post-2020***. Discussions have started but it could take years before legislative changes are implemented.
2. For a variety of reasons, ***allowance prices*** have been low (below EUR 15/ton) for significant portions of all three Phases.
3. A predicted excessive supply of allowances appears likely to represent an issue for the next decade.
4. Other policies have been introduced that overlap with the EU ETS, and have contributed to undermining its perceived effectiveness.

LESSONS:

1. ***Obtaining verified emissions information at the outset of a cap-and-trade program***, through a pilot phase or other mechanism, is important for setting caps that avoid overallocation.
2. ***Long-term policy certainty*** is fundamental. A long-term planning horizon creates certainty, allowing companies to make low-cost and customized investments for the future.
3. ***Harmonized measuring, reporting and verification and allowance distribution mechanisms*** are essential for the cost- and time-efficient continuation of the ETS.
4. ***Allowing flexibility between subsequent phases*** through banking and borrowing provisions reduces possible problems that can arise from overallocation, such as severe price fluctuations, and can help to manage compliance costs.
5. ***Grandfathering of allowances*** may have political benefits but can create opportunities for gaming and can lead to sectoral distortions among member states. Full auctioning of allowances, a single EU-wide cap, and harmonization of transitional free allocation schemes at the EU level may correct these distortions.

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If you have any comments or suggestions for this case study, please do not hesitate to contact lead authors:

EDF co-author: Peter Sopher
EDF contact: Daniel Francis (dfrancis@edf.org)
Environmental Defense Fund (EDF)
1875 Connecticut Ave NW Ste. 600
Washington, DC

IETA co-author: Anthony Mansell
IETA contact: Robin Fraser (fraser@ieta.org)
International Emissions Trading Association (IETA)
20 F St NW Suite 700
Washington, DC

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Disclaimer: The authors encourage readers to please contact the EDF and IETA contacts with any corrections, additions, revisions, or any other comments, including any relevant citations. This will be invaluable in strengthening and updating the case studies and ensuring they are as correct and informative as possible.

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[8] *Supra*, Note 4.
[9] Europa (March 2011). "Climate change: Commission sets out Roadmap for building a competitive low-carbon Europe by 2050." Available at http://europa.eu/rapid/pressReleasesAction.do?reference=IP/11/272
[10] *Supra*, Note 5.
[11] The 27 EU nations, Iceland, Liechtenstein, and Norway. Source: *Supra*, Note 3.
[12] *Supra*, Note 5.
[13] *Supra*, Note 3.
[14] *Supra*, Note 3.
[15] *Supra*, Note 3.
[16] *Supra*, Note 5.
[17] The EU's internal burden sharing agreement enabled member states to set their own national caps. While member states had an economy-wide target under the Kyoto Protocol, they were each able to determine which domestic sectors to cap with relatively more or less stringency.
[18] *Supra*, Note 2.
[19] *Supra*, Note 5.
[20] *Supra*, Note 2.
[21] *Supra*, Note 4.
[22] Dimireva, Ina (July 2010). "Emissions trading: EU ETS cap 2013 – briefing." EU Business. Available at http://www.eubusiness.com/topics/environ/emissions-trading-2013/
[23] *Supra*, Note 5.
[24] Under article 10c of the ETS Directive, ten EU member states have the option to transitionally allocate free allowances to the power sector between 2013 and 2019. Eight of the ten member states have decided to apply for this option.
[25] *Supra*, Note 4.
[26] The amount of auctioned allowances will gradually increase to 70% in 2020 aiming at reaching 100% auctioning by 2027. Source: *Supra*, Note 8.
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[33] http://eur-lex.europa.eu/LexUrizerv/LexUrizerv.do?uri=OJ:L:2009:008:0003:0021:EN:PDF
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[35] With exception of 7 Member States who are entitled to grant free allocation to the power sector for a transitory period and on the basis of real investments in carbon reductions.
[36] *Supra*, Note 4.
[37] Hood, Christina (November 2010). "Reviewing Existing and Proposed Emissions Trading Systems." OECD/IEA. Available at http://www.iea.org/publications/freepublications/publication/ets_paper2010.pdf
[38] *Supra*, Note 3.
[39] *Supra*, Note 5.
[40] For more information on possible proposals for addressing oversupply in the EU ETS, see IETA (October 2012) "Options to Reform the EU ETS" Available: https://ieta.memberclicks.net/assets/EUWG/letter_ieta_ets_reform_options_5-10-2012.pdf
[41] *Supra*, Note 4.
[42] *Supra*, Note 5.
[43] *Supra*, Note 5.
[44] Based on internal EDF analysis.
[45] Articles 9 to 11, and Annex III of the Directive 2003/87/EC, and communication, COM (2003) 830.
[46] *Supra*, Note 2.
[47] *Supra*, Note 4.
[48] European Commission (EC) (May 2010). "Analysis of options to move beyond 20% greenhouse gas emission reductions and assessing the risk of carbon leakage." Commission staff working document. Available at http://ec.europa.eu/clima/policies/international/negotiations/future/docs/sec_2010_650_part2_en.pdf
[49] *Supra*, Note 39.
[50] *Supra*, Note 2.
[51] *Supra*, Note 2.
[52] *Supra*, Note 34.
[53] European Commission (EC) (January 2013). "International carbon market." Available at http://ec.europa.eu/clima/policies/ets/linking/index_en.htm
[54] *Supra*, Note 3.
[55] *Supra*, Note 5.
[56] *Supra*, Note 3.
[57] *Supra*, Note 3.
[58] *Supra*, Note 5.
[59] 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 0.09% of annual transactions. EU governments lost substantially 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.
[60] Hanafi, Alex, Lucas Merrill Brown, and Annie Petsonk (2012). "The EU Emissions Trading System: Results and Lessons Learned." Environmental Defense Fund (EDF). Available at http://www.edf.org/sites/default/files/EU_ETS_Lessons_Learned_Report_EDF.pdf
[61] *Supra*, Note 3.
[62] *Supra*, Note 5.
[63] *Supra*, Note 39.
[64] http://www.pointcarbon.com/polopoly_fs/1.2576171!The%20EU%20ETS%20in%202030.pdf

[65] Ellerman, Danny A., Frank J. Convery, Christian de Perthuis. "Pricing Carbon: The European Union Emissions Trading Scheme." Cambridge University Press. 2010.
[66] *Supra*, Note 2.
[67] *Supra*, Note 2.
[68] *Supra*, Note 65.
[69] Rob Elsworth and Bryony Worthington (2010), "International Offsets and the EU 2009," Sandbag, July 2010, at 4, available at sandbag.org.uk/site_media/pdfs/reports/offset2009.pdf
[70] European Commisions (EC) (2009). "EU action against climate change." Available at http://ec.europa.eu/clima/publications/docs/ets_en.pdf
[71] *Supra*, Note 65.