

**Final Scientific Report for the Swiss Network for International Studies
(SNIS)**

**Project “Designing Effective Regulation for Carbon Markets at the
International, National, and Subnational Level”**

Project Coordinator:

Prof. Dr. Regina Betz

Center for Energy and the Environment, School of Management and Law, ZHAW

betz@zhaw.ch

Winterthur, November 2021

1. Executive Summary

Carbon markets are an increasingly common policy instrument being introduced to address climate change mitigation. However, their design is crucial to ensure that they deliver cost-effective emission reductions while maintaining environmental integrity. Using a combination of literature review, legal analysis, statistical, and network analysis, this project combined insights from economics, law, and political science to put together a comprehensive, principle-based overview of the risks and abuses to environmental integrity and cost effectiveness that have emerged in carbon markets at all jurisdictional levels around the world.

The project took stock of the experience and lessons learned in both baseline-and-credit systems (particularly the Kyoto Protocol's Clean Development Mechanism and Joint Implementation) and cap-and-trade systems (including the EU ETS, the Swiss ETS, the New Zealand ETS, RGGI in the US, among others).

While baseline-and-credit systems appear to be vulnerable to conflict of interest situations at various steps along individual project approval processes, cap-and-trade systems seem to be prone to the more systemic effects of lobbying by those industries that will be negatively affected by the policy. Such lobbying may lead to weaker rules and provisions on several design aspects of ETSs, which reduce the environmental effectiveness of the whole system.

Baseline-and-credit systems are thus vulnerable to abuses in the determination of additionality and the establishment of a credible baseline for individual projects. Independent verification, hiring of verifiers by the regulators instead of the project developers, careful checks and wherever possible standardization of critical project parameters that affect additionality, and ex-post spot checks are therefore crucial to ensure environmental integrity. If inflated baselines or non-additionality are discovered ex-post, this should lead to make-good provisions for credits that have already been issued, and to rejection of future issuances.

In contrast, cap-and-trade systems are particularly vulnerable to (i) lenient cap setting, which can lead to overallocation and surplus of allowances, and therefore low allowance prices and lower incentives to invest in mitigation; (ii) overshooting the cap if no make-good provisions for non-compliance exist, if firms go insolvent without fulfilling their allowance surrender obligations, if natural sinks are included from which the sequestered carbon can be accidentally released through forest fires, among other causes; and (iii) perverse incentives related to how allowances are distributed, which might encourage rent maximization rather than efficient mitigation. Our recommendations on these aspects are detailed in the full report.

In addition, there are challenges that affect both types of markets equally. Such risks arise if the rules for monitoring, reporting, and verification of emissions and emission reductions are not stringent enough, if inaccurate reporting is not detected, or if the penalty for non-compliance is not high enough. A balance between keeping administrative costs low and allocating sufficient staff to on-the-spot inspections needs to be found. Further risks emerge during trading, including value-added-tax fraud, money laundering, other tax evasion, allowance theft, or selling fake credits or allowances. All of these have mainly financial impacts, affecting market efficiency and trust in the market. Data sharing and transparency, market oversight, know-your-customer checks, and coherent rules are important to reduce these risks.

A central finding of the project is that the risks to the environmental integrity and economic efficiency of carbon markets become larger when different markets – with diverse sets of

rules, authorities, and participants – are linked with each other. Under these circumstances of decentralized authority, regulation can become insufficient, patchy, and uncoordinated. The cases of VAT fraud that were detected in the EU ETS or the double use of CERs under the EU ETS are a typical example of incompatible rules across jurisdictions.

The rules for the market mechanisms under Article 6 of the Paris Agreement were finally decided upon in November 2021, towards the end of the project's timeline, and after various years of stalled negotiations. These rules make clear that separate carbon markets will become more interconnected than ever: not only national and regional ETS may become linked indirectly through the Paris Agreement's Sustainable Development Mechanism, and through trading of carbon certificates across countries, but the Paris Mechanisms will likely be connected to CORSIA – the offset system for the international aviation sector – and to the voluntary carbon market. Our recommendations on transparency, data sharing, consistent rules and regulations, and tight coordination across regulatory agencies will in this context become even more important.

Beyond these lessons from existing markets, the project has also made two important empirical contributions. First, it has laid out the foundations for improved empirical methods to detect suspicious transactions in carbon market trading. This work, as well as an analysis of the political economic determinants of trading behavior, will be continued by Raphaela Kotsch in the framework of her PhD thesis. Second, it has put together a corpus of country position papers on carbon markets, and used it to test computer-assisted, quantitative methods for the coding of negotiation positions out of unstructured documents. These methods have allowed us to describe and explain which countries are more likely to support more environmentally integer carbon markets in the UN negotiations on international carbon market mechanisms. Raphaela Kotsch will also continue working with this data to further investigate the determinants of negotiation positions on carbon markets.

2. Abstract of Executive Summary

Carbon markets are an increasingly common policy instrument being introduced to address climate change mitigation. However, their design is crucial to ensure that they deliver cost-effective emission reductions while maintaining environmental integrity. Using a combination of literature review, legal analysis, statistical and network analysis, this project combined insights from economics, law, and political science to put together a comprehensive, principle-based overview of the risks and abuses to environmental integrity and cost effectiveness that have emerged in carbon markets at all jurisdictional levels around the world. It describes concrete examples, offers effective policy and governance solutions to overcome such risks, and provides an outlook to new risks and challenges arising from the newest developments in climate governance. Finally, it applied quantitative text analysis methods to describe and explain which countries are more likely to support more environmentally integer carbon markets in the UN negotiations on international carbon market mechanisms.

3. Scientific Report

This final report details the main findings of the SNIS-funded project “Designing Effective Regulation for Carbon Markets at the International, National, and Subnational Level”, which started in January 2019 and finished in November 2021, after an extension granted due to the Coronavirus pandemic. The report first outlines the project’s research questions, describes the methods used to answer them, presents and discusses the results, and concludes with the academic and practical relevance of the work.

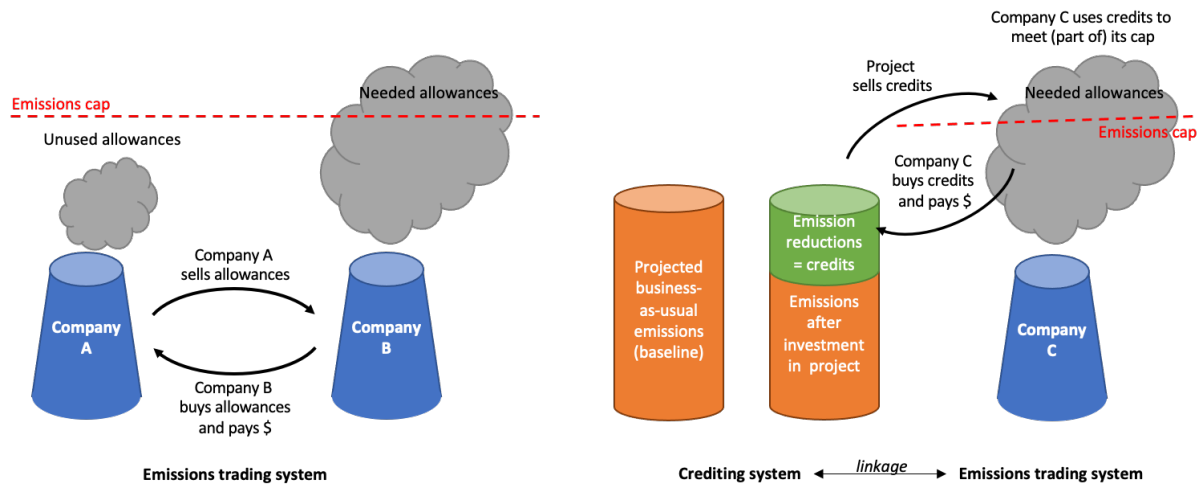
3.1 Introduction

Carbon market mechanisms are considered a crucial policy for greenhouse gas mitigation. So far, more than 50 carbon markets exist around the world at the international, regional, and national level (World Bank 2021), and more are being planned. However, carbon markets have been subject to substantial abuses in the past, understood here as any action by an individual or a small group of individuals to exploit the market to their own advantage. These have included traditional market abuses such as price manipulation, VAT fraud, money laundering, collusion, cyber-attacks, and other predatory behavior, and carbon-market-specific abuses such as using false information in project documentation to achieve registration of non-additional projects or the misreporting of performance data to increase the number of credits issued (Michaelowa 2009; Interpol 2013; Branger et al. 2015; Frunza 2015; Kollmuss et al. 2015; Schneider & Kollmuss 2015; Liu & Cui 2017; Michaelowa and Michaelowa 2017).

Despite evidence of these abuses and analysis of how they can individually be addressed, little is still known about how a regulatory framework should look like to effectively prevent such market abuses. This project therefore combined insights from economics, political science and law to (i) theoretically derive guiding principles for a multi-level carbon market regulatory oversight, (ii) draw lessons from the regulatory and oversight frameworks developed for existing carbon and other related (i.e. financial) markets, (iii) empirically investigate the kinds of market abuses that have already taken place in national and international carbon markets, (iv) develop a best-practice regulatory framework for national and international carbon markets, and (v) identify how international cooperation can be promoted to implement such a regulatory framework.

The analysis distinguished between the two main types of carbon markets (see Figure 1): cap-and-trade and baseline-and-credit systems. Methodologically, we drew on a combination of literature review, legal analysis, application of economic theory for the assessment of existing markets, and the long-standing expertise of the team in the design of carbon markets to reach the goals (i), (ii) and (iv) above. To investigate past carbon market abuses (goal iii), we compiled data on international carbon market transfers and analyzed it using a combination of statistical methods and social network analysis. To study international cooperation on regulatory frameworks for carbon markets (goal v), we drew on computer-assisted content analysis of position papers on carbon markets (so-called natural language processing methods).

Figure 1: Main types of carbon markets: Cap-and-trade (or emissions trading) systems and baseline-and-credit (or crediting) systems.



3.2 Results and Analysis

3.2.1 Principles and rules for guiding an effective and feasible multi-level carbon market regulatory oversight

In an article published in *Ecology Law Quarterly* (see output), Michael Mehling assesses market and regulatory failures in the carbon market as justification and grounds for regulatory intervention, and formulates principles – based on economic and regulatory theory, historical case studies and legal analysis – to strike an adequate balance between over- and underregulation of market-based cooperation under Article 6 of the Paris Agreement.

An in-depth literature review on the development of international carbon markets over time (“Evolution of international carbon markets: lessons for the Paris Agreement”) was published by Axel Michaelowa and co-authors in the journal *WIREs Climate Change* (see output). The paper identifies four key phases of development of international carbon markets since the 1990s. It finds that the emergence of principles happened essentially in the first phase and they have not changed since then, but that the operationalization of the principles into robust rules took a lot of time. Particularly the criticism of the Clean Development Mechanism after its “gold rush period” from 2004 to 2007 by NGOs and researchers contributed to a significant improvement of the specific rules and a reduction of problematic projects.

Moreover, in a paper “Additionality revisited: guarding the integrity of market mechanisms under the Paris Agreement” in the journal *Climate Policy* (see output), Axel Michaelowa and co-authors discuss the additionality principle that should underlie the market mechanisms under the Paris Agreement and make proposals regarding specific rules for operationalizing this principle.

Drawing on all this work, on literature review, and our own expertise from economics, law, and environmental sciences, the team compiled a set of principles applicable to the regulation of carbon markets. Legal principles were written by Michael Mehling and economic principles that guide carbon markets were written by Raphaela Kotsch, Regina Betz and Andrea Baranzini. The applicability of these principles to the two types of carbon markets and their different stages (design, implementation, and trading) was analyzed. This compilation

and analysis form the core of Chapter 2 of the book manuscript (see output report), which proposes a principle-based assessment framework for the regulation of carbon markets.

Based on the analysis, the team identified environmental integrity and economic efficiency as the overarching principles, which were applied throughout the book to assess existing and propose improved regulatory systems for carbon markets.

3.2.2 Risks of market abuse in the past, possibilities for detection, and potential future risks

The literature on market abuse was reviewed by Raphaela Kotsch for her PhD proposal. In the project team meetings we discussed different market abuses, identified risks and classified them.

Risks for baseline-and-credit systems

A crucial aspect that affects baseline-and-credit systems is the prevalence of **conflicts of interest** among all market participants: Most stakeholders directly involved in the market (project developers, credit buyers, host country governments, validators) have an incentive to set the baseline in a way that the generated emission reduction credits are maximized. As these markets rely on myriad of approval decisions for individual projects, such conflicts of interests, as well as the potential for corruption, are the main drivers of the risks to the environmental integrity of these markets.

Setting a correct **baseline** – this is, establishing the counterfactual situation that would have occurred in the absence of the carbon market – is key to ensuring the environmental integrity of carbon credits. The team identified examples of baseline manipulation in the former international carbon markets under the Kyoto Protocol – the Clean Development Mechanism (CDM) and Joint Implementation (JI), and derived corresponding policy suggestions (see book manuscript). In short, baselines should not be set by any entities that benefit from credit sales without independent validation. Validators should be commissioned by the regulatory authorities rather than by the project developers, and should be subject to strict accreditation processes and spot checks. Regulators should also run ex-post checks of registered projects to ensure that baselines have not been manipulated. If manipulated baselines are detected, the project developer should be obliged to make good on any excess credits that may have been issued.

Another major issue that impaired the CDM was insufficient **additionality**. The lack of proper regulatory oversight that led to many non-additional projects in the gold rush phase of the CDM and the subsequent regulatory improvements are discussed by Axel Michaelowa and co-authors in the *WIREs* paper (see output). Specific project parameters that regulators need to carefully scrutinize in order to assess additionality – such as plant load factors, internal rates of return, prices for inputs, etc. – are in addition highlighted in the book manuscript.

The threat of non-additionality also exists in a potential market mechanism under the Paris Agreement. Axel Michaelowa (with co-authors) focused on this topic in a *Climate Policy* article on how additionality testing and rules should look like in the future. The article shows that without additionality testing, market mechanisms under the Paris Agreements might lead to an international diffusion of 'hot air'. To avoid this, an independent assessment of NDC ambition is necessary. Otherwise, activities under the mechanisms need to undergo specific

additionality tests. Additionality testing of projects and programmes should build on the experience developed under the Kyoto Protocol mechanisms. Bold approaches are needed for assessing additionality of policies. To avoid a cumbersome assessment of all activities triggered by such policies, highly aggregated approaches are suggested, ranging from payback period thresholds for technologies mandated by regulation to minimum price levels triggered by carbon pricing policies. Over time, the stringency of threshold values should increase.

Further risks to the Article 6 mechanisms were identified and discussed in a specific subchapter of the book manuscript, in particular the risk of **double counting** of emission reductions, and the need for corresponding adjustment to minimize this risk.

Risks for cap-and-trade systems

In contrast to baseline-and-credit markets, the quality of a cap-and-trade systems depends much more strongly on the general design characteristics of the market, such as the stringency of the cap, the rules for trading, the linking with offset markets, the extent of free allocation, monitoring, enforcement and sanctioning rules, etc. For this reason, the risks for cap-and-trade systems are driven by the **lobbying pressures** from potential losers from the market. At each decision-making step by regulators, lobbyists will try to lower the sectoral coverage of the system, reduce the cap stringency, or affect other design elements so that it is easier and cheaper for them to comply. This leads to several risks to the appropriate functioning of these markets, which we described, illustrated and discussed in detail in the book manuscript, in addition to proposing regulatory solutions. A summary is presented below.

The first major risk relates to the **stringency of the cap**. If more allowances are allocated to the market than needed, or if a surplus is generated over time due to an unforeseen economic crisis or because of overlapping climate policies, the result is that the supply of allowances exceeds their demand. This leads to lower allowance prices, which decreases the incentive for participating companies to actually invest in reducing emissions. Most existing cap-and-trade systems have suffered from overallocation. A solid cap-setting process based on accurate sectoral data and with clear rules is key to reduce the risk of overallocation. A further option to address unforeseeable situations are flexible caps, which can be adjusted if the macroeconomic conditions change, but which offer sufficient certainty to investors by establishing clear emissions corridors. Reducing the possibility of banking allowances across commitment periods, as well as setting limits to the use of offsets can also help to avoid a surplus. Finally, market stability mechanisms – which set maximum and/or minimum bounds on the price of allowances or on the abatement requirement, so that once those thresholds are reached, excess allowances are transferred to a reserve, have also been introduced successfully to reduce surplus.

The second risk entails **overshooting the cap**, meaning that the emissions monitored within the ETS are higher than the cap. This can happen, for example, if a company fails to meet its cap (i.e., it surrenders fewer allowances than required to cover its emissions), and then pays a penalty for non-compliance without having to surrender the missing allowances. It can also happen if a company underreports its emissions and goes undetected. A third reason is in the case of a bankruptcy, if the company had not surrendered the required allowances before falling bankrupt and if the insolvency administrator fails to fulfil this duty, then the cap will be overshooted. If a cap-and-trade system covers biological sinks, such as forests, there is a risk that the sequestered carbon is released again because of forest fires or other disasters. Overshooting of the cap impacts the environmental integrity of the system negatively, as it results in more emissions than originally foreseen. The identified recommendations to avoid

overshooting the cap include high financial penalties with make-good provisions in the case of non-compliance, appropriate legislation for cases of insolvency, and using compensation, insurance, buffer pools or temporary credits to address potential reversals in the forestry sector.

A third risk consists of **setting perverse incentives** for firms because of the free allocation of allowances. If allowances are allocated for free, for example, companies may have a lower incentive to invest in emission reductions if they do not realize that they could sell their allowances on the market. Free allocation may also create a distorted playing field for new companies. This all leads to a less efficient market. The clear solution to these problems is to auction the allowances instead of distributing them for free, which is however politically more difficult to implement.

Cross-cutting risks and risks during the trading phase

In a Working Paper entitled “The end of the Kyoto Protocol era: What can we learn from the global trade of Emissions Reduction Units applying network analysis?”, Raphaela Kotsch, Regina Betz, Peter Schwendner and Jan Abrell combined data from different carbon markets (from the EU ETS, from the Swiss ETS, and from the Kyoto Protocol registries) to identify the properties of the trading network of Emission Reduction Units in the EU and Swiss ETS, and to investigate which sectors and countries played a central role in that trading network. A combination of network and regression analysis revealed (i) that ERUs are traded along long trading chains involving jurisdictions such as Jersey or Switzerland outside the main issuing countries (e.g., Ukraine and Russia) and surrendering countries (e.g., Germany, New Zealand). (ii) The analysis also revealed that commodity traders and financial institutions were major players in the ERU market in the First Kyoto Commitment Period (2008-12) and enabled “hot air” from Russia and Ukraine to enter the market. Overall, this analysis helps us to understand what can happen when several carbon markets are linked with each other – some of them with insufficient oversight –, and when speculative and gain-oriented (rather than compliance-oriented) participants are allowed into a market.

Overall, an important finding of the project is that the risks affecting carbon markets are compounded when several markets – with potentially incompatible regulations and governance structures – are interlinked. Oftentimes, regulatory incompatibilities and loopholes are detected only after linking. So, while linking markets should theoretically result in higher efficiency, as it creates a larger pool of emission abatement options and a more uniform price of carbon units, in reality it increases the potential for market abuses due to regulatory loopholes, insufficient coordination and exchange of information. For this reason, similar standards in cap setting, monitoring, reporting and verification (MRV), and sanctions, as well as a joint oversight system and great transparency are necessary to avoid abuses in interlinked carbon markets.

In the book manuscript, we review existing literature on other abuses that have been identified in carbon market trading, including criminal activities such as VAT fraud, money laundering, and theft of allowances; double counting of allowances or credits; or the potential for market manipulation by participants with market power. We then propose regulatory approaches to address these risks, including greater controls on who can access the market and its registry, know-your-customer checks, more centralized market governance, more coherent regulations, effective enforcement, and sufficient staffing and systems to detect fraud and suspicious trades in real time.

In addition, transparency is key to detecting and addressing many of the risks identified above, including open, sufficient, up-to-date and solid data on emissions trends, real-time data on market transactions, robust registries and transaction logs, also across interlinked markets.

Challenges related to carbon markets with net-zero targets

According to the Paris Agreement, by mid-century a balance between greenhouse gas emissions and removals needs to be reached to avoid dangerous climate change. Several countries have therefore already adopted net-zero targets. Carbon markets have been so far conceived as tools to incentivize emission reductions through, for example, energy efficiency measures or switching from fossil fuels to cleaner energy sources. To achieve net-zero emissions, however, emission reductions will have to be complemented with activities that capture CO₂ from the atmosphere and that generate negative emissions, including natural sinks (e.g., afforestation, reforestation, improvement of agricultural soil carbon content) and artificial storage (e.g., carbon capture and storage – CCS, or carbon capture and utilization – CCU). These developments set new challenges for the design of carbon markets.

For example, new approaches for baseline setting will be needed if the goal is to have zero or even negative emissions. In their CIS Working Paper (see output), Axel Michaelowa, Katharina Michaelowa and external colleagues have therefore proposed dynamic baselines that look forward towards net-zero emissions targets. These baselines would allow the tradable volumes of carbon to be assessed against an increase in ambition in line with those net-zero targets and with basic country characteristics, notable the level of development. As further discussed in the book manuscript, once countries start to adopt ‘net-negative’ targets (i.e., targets that involve achieving a specific amount of greenhouse gas removals), baselines would have to become negative and measure ‘removal intensity’ instead of the current emissions intensity.

So far, free allocation of allowances has been the main tool to reduce the incentives for industry to relocate to countries with less stringent climate regulations. In a net-zero world free allocation will no longer be possible, and other approaches will be needed to maintain industrial competitiveness. Carbon border adjustment mechanisms are being discussed in this context. In the book manuscript, we argue that carbon markets could be integrated into such mechanisms.

As discussed in the book manuscript, carbon markets that include natural sinks will need solid approaches to address the risks of leakage – i.e., that reforestation activities lead to increased deforestation somewhere else – and of accidental re-release of the stored CO₂. Existing options include insurance and creating a reserve to keep a portion of the generated credits to compensate for future reversals.

In addition, carbon markets will only be able to incentivize negative emission technologies once the carbon price is high enough to cover their costs. New rules will have to be designed to divide the carbon market units generated through CCS among the various actors involved in capturing, transporting and storing the carbon. Rules on liability and compensation – similar to those for accidental reversal from forestry projects – are needed in case part of the carbon leaks again to the atmosphere during transportation and storage. Given that CO₂ may be traded internationally to appropriate storage sites, such rules will need to be applicable and enforceable across borders.

New risks, such as land conflicts, food security, loss of biodiversity, as well as potential co-benefits will need to be addressed and reflected adequately.

3.2.3 To what extent are existing market regulations and enforcement practices addressing the risks identified above

To answer this question, the team reviewed the existing literature and experience with carbon markets around the world. Lessons learned from many existing markets (including the EU ETS, the New Zealand ETS, the Swiss ETS, the California ETS, CDM, JI, RGGI, Korea and Chinese ETS) were used in the book manuscript to discuss which market regulations have been successful in addressing the specific risks described above and which ones have suffered from abuses in the past.

In addition, Axel Michaelowa and co-authors in their *WIREs* paper (see output) discuss the performance of the Kyoto Mechanisms with regard to key risks identified by researchers and NGOs and the resulting regulatory response over time.

Rainer Baisch and Rolf H. Weber assess in their *Jusletter* paper (see output) the linking of the Swiss and EU ETS, as well as the reform of the EU ETS for Phase 4 and the implications of considering emission certificates as financial instruments rather than commodities under EU law. For example, since 2019 MiFID II also includes spot trading in emission certificates to reduce the various risks related to trading. A further tightening of the legal provisions on the EU Registry Regulation is intended to limit undesirable activities by closing the entrance door to unwished market participants that may engage in scam, theft, market abuse and tax fraud. The paper also discusses the potential trade-off between the two goals of the ETS, namely achieving emission reductions at the lowest possible cost (economic efficiency), or establishing an effective price signal to incentivize more mitigation. It discusses that while the first of these goals has so far been achieved, ensuring the second one has required the introduction of more stringent regulation, such as the market stability reserve.

Rainer Baisch and Michael Mehling are completing a paper that examines the role financial market regulation in carbon trading, with a working title of “Carbon Market Oversight and the Role of Financial Market Regulation.” With this paper, the authors highlight the importance of market oversight for robust carbon trading and highlight examples of manipulation, abuse and criminal activities in existing carbon markets. Based on this assessment, they define oversight requirements for a functioning carbon market, and proceed to map relevant principles, instruments and procedures applied in the oversight of traditional financial markets, discussing their relevance for carbon trading. Their analysis shows how financial market regulation has played a role in the governance of carbon trading, but also has had to be adapted to the unique context and evolving circumstances of different carbon markets.

Finally, in his paper manuscript “The Future of Offsetting Carbon Emissions in the Aviation Industry”, Rainer Baisch reviewed the literature on the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA), the scheme that was introduced in 2016 by the International Civil Aviation Organization (ICAO) to compensate the growing greenhouse gas emissions in the international commercial aviation sector, and compared the design of this scheme with the provisions for aviation within the EU ETS. CORSIA is an offset scheme – therefore, a baseline-and-credit mechanism that allows airlines to buy emission reduction projects from, e.g., forestry projects, to compensate for their own emissions. It is conceived as an interim approach until sustainable aviation fuels can be deployed on scale. For the EU, it applies to international flights to and from non-European destinations. The EU, in contrast, is a cap-and-trade system that has set a limit on aviation emissions for flights within and

between EU member states. In summary, the EU ETS is a more ambitious in its aim of reducing aviation emissions than CORSIA, whose aim is merely to stabilize emissions.

As a baseline-and-credit mechanism, CORSIA will have to ensure that the credits allowed are (i) additional; (ii) based on a credible baseline; (iii) quantified, monitored, reported and verified; (iv) have a transparent chain of custody; (v) represent permanent emission reductions; (vi) address the potential increase in emissions elsewhere (leakage); (vii) are only counted once towards mitigation obligations; and (viii) do no net harm (ICAO 2019: p.2). Because CORSIA is an international mechanism, it will be up to national regulators to enforce these and other rules. Information on this does not yet exist, because the downturn in international aviation resulting from the Coronavirus pandemic has in practice delayed the implementation of the scheme – probably until 2024.

Another important aspect of CORSIA is how it will relate with the international emission reduction commitments under the Paris Agreement to, for example, avoid double counting of emission reductions. Double counting could for example happen if emission reductions from a mitigation project are acquired by airlines to comply with CORSIA, but at the same time accounted by the host project as part of its Nationally Determined Contribution under the Paris Agreement. The rules on this were only agreed in November 2021 at the Glasgow Climate Conference and could therefore not be incorporated into the project.

3.2.4 Promoting cooperation for effective carbon market regulation and oversight

Paula Castro and Raphaela Kotsch collected and systematized data on UNFCCC member countries' negotiation positions regarding carbon markets, obtained from written submissions to UNFCCC bodies that were webscraped from the UNFCCC website. The data covers a total of 6048 position papers for the period 1995-2020, out of which 2271 documents have some text that is relevant for carbon markets. In their Working Paper entitled "Quantitative Text Analysis Methods to Explain Country Positions on Carbon Markets in Climate Negotiations", they compare and apply two computer-based text analysis methods to analyze a sample of 235 of these documents, covering the negotiations on carbon markets under the Paris Agreement in the period 2015-2020. The paper is based on the theoretical framework that carbon markets inherit potential trade-offs (identified in the previous parts of the project) between the environmental integrity and the economic efficiency of carbon markets and seeks to identify which countries support which of those two goals of carbon markets. The aims of the paper are therefore twofold: first, to identify an appropriate automatized method to identify sections of text that relate to carbon markets and classify them according to the negotiation positions that they display; second, to use this classification to understand countries' motivation to support or obstruct high quality carbon markets.

The chosen methods – structural topic models and word embeddings – are appropriate to identify sections of text that are related to carbon markets. The structural topic model accurately reflects the issues under negotiation in a cleanly distinguishable way. It allows us to identify sections of text that most frequently include terms related to the environmental integrity of carbon markets and those sections of text that rather relate to well-functioning and efficient markets. On the basis of how prevalent these two aspects are in the position papers, we are able to assess which countries seem to be more concerned by the environmental implications of relying on carbon markets, and which ones by their efficiency. While countries that have in the past been buyers of international carbon credits tend to support markets that are both, environmentally integer and efficient, among the seller countries there are wider differences. Brazil and the Russian Federation, for example, stand out as caring

more for efficiency than for environmental integrity, which is in line with anecdotal information from the negotiations.

The word embeddings approach is useful for identifying similar positions across countries and groups, including both the similarity in their use of words related to environmental integrity, and the similarity of the whole texts. The results from both approaches are comparable.

In a second step, network analysis allows us to explore explanations of countries' positions on carbon markets. The network graphs show that countries within coalition groups that have been actively engaged in discussions on carbon markets – including the Environmental Integrity Group (EIG), the Alliance of Small Island States (AOSIS) and the Association of Independent Latin American Countries (AILAC) – tend to display similar positions in their written submissions. This finding is similar in the topic modelling and the word embeddings approaches. The graphs also show Brazil – with its rather extreme position against environmentally friendly carbon markets – as an isolated player in the negotiations.

Following feedback from the conferences in which this paper has already been presented (see output), the next steps include subdividing it into two papers, one focusing on the measurement aspect of the positions, and the second one on the explanation of those positions. In addition, we are currently working with two master students to test a further text analysis method that requires hand-coding of a sample of texts in order to train a model for all others. Once the first methodological paper is published, we will also publish the underlying data – including the corpus of carbon market position papers – for use by other researchers. In the framework of her PhD thesis, finally, Raphaela Kotsch will continue working on proposing and testing political economic drivers of countries' negotiation positions on carbon markets.

3.2.5 Synthesis: Requirements for a feasible and effective regulation of carbon markets

The goal of this work package was to publish a guide on how to implement an effective carbon market while avoiding the risks identified by the project. A book manuscript entitled "*The Carbon Market Challenge: Preventing Abuse Through Effective Governance*" has been written by Regina Betz, Axel Michaelowa, Paula Castro, Raphaela Kotsch, Michael Mehling, Katharina Michaelowa and Andrea Baranzini. It was submitted in September 2021 to Cambridge University Press for publication in its Elements in Earth System Governance series, and we are currently awaiting the feedback from the peer review process. Once we receive the feedback from the peer review process, we aim to update some sections of the book manuscript to reflect the outcomes of the international negotiations on carbon markets that were reached in November 2021 at the Glasgow Climate Meeting, and we have secured financing to publish the volume open source.

3.3 Conclusion and Outlook

Along the project, we took stock of the experience and lessons learned in existing carbon markets at various jurisdictional levels across the world, covering both baseline-and-credit systems (particularly the Kyoto Protocol's Clean Development Mechanism and Joint Implementation), as well as cap-and-trade systems (including the EU ETS, the Swiss ETS, the New Zealand ETS, RGGI in the US, among others).

While baseline-and-credit systems appear to be vulnerable to conflict of interest situations at various steps along individual project approval processes, cap-and-trade systems seem to be prone to the more systemic effects of lobbying by those industries that will be negatively

affected by the policy. Such lobbying may lead to weaker rules and provisions on several design aspects of ETSs.

A further, central finding is that the risks to the environmental integrity and economic efficiency of carbon markets become larger when different markets – with diverse sets of rules, authorities, and participants – are linked with each other. Under these circumstances of decentralized authority, regulation can become insufficient, patchy, and uncoordinated.

The rules for the market mechanisms under Article 6 of the Paris Agreement were finally decided upon in November 2021, towards the end of the project's timeline, and after various years of stalled negotiations. These rules make clear that separate carbon markets will become more interconnected than ever: not only national and regional ETS may become linked indirectly through the Paris Agreement's Sustainable Development Mechanism, and through trading of carbon certificates across countries, but the Paris Sustainable Development Mechanism will likely be connected to CORSIA – the offset system for the international aviation sector – and to the voluntary carbon market. Our recommendations on transparency, data sharing, consistent rules and regulations, and tight coordination across regulatory agencies will in this context become even more important.

At the same time, the EU is planning the adoption of a new emissions trading system for the buildings and road transport sectors. The design of these markets will be a new challenge due to the composition of those sectors, which lack the large source installations that traditional ETSs focus on and therefore the emissions will be covered upstream by the importers of fossil fuels or refineries.

As pointed out above, in addition, many countries are adopting net-zero emissions targets, and supporting the introduction of carbon capture and negative emissions technologies in order to meet those goals.

All these new developments imply the need for further research on carbon market design and regulatory oversight.

We are planning to continue our work in this area. Raphaela Kotsch will continue working on her PhD thesis, with two further articles planned on the political economy factors affecting carbon market behavior as well as those affecting countries' positions on carbon markets in the UNFCCC negotiations. In addition, in the framework of a fellowship from the Digitalization Initiative of the Zurich Higher Education Institutions (DIZH), she will continue investigating the applications of machine learning methods to carbon markets, for example in the context of detecting fraudulent trades and develop a tool which allows to detect trustful trading partners. In the context of a new Flagship Initiative being funded by Innosuisse, Regina Betz and part of her team will consider policy designs to support negative carbon technologies in Switzerland, likely including carbon markets.

3.4 References

Branger, F., Lecuyer, O., & Quirion, P. (2015). The European Union Emissions Trading Scheme: should we throw the flagship out with the bathwater? *Climatic Change* 6:1, 9–16.

Frunza, M.-C. (2015). *Fraud and Carbon Markets: The Carbon Connection*. London: Routledge.

International Civil Aviation Organisation (ICAO). (2019). *CORSIA Emissions Unit Eligibility Criteria*. Montreal: ICAO. https://www.icao.int/environmental-protection/CORSIA/Documents/ICAO_Document_09.pdf

International Criminal Police Organisation (INTERPOL). (2013). *Guide to Carbon Trading Crime*. Paris: Interpol.

Kollmuss, A., Schneider, L., & Zhezherin, V. (2015). *Has Joint Implementation Reduced GHG Emissions? Lessons Learned for the Design of Carbon Market Mechanisms*. SEI Working Paper No. 2015-07. Stockholm: Stockholm Environment Institute.

Liu, X. & Cui, Q. (2017). Baseline manipulation in voluntary carbon offset programs. *Energy Policy* 111, 9–17.

Michaelowa, A. (2009). Interpreting the additionality of CDM Projects: Changes in additionality definitions and regulatory practices over time. In: *Legal Aspects of Carbon Trading*, ed. D. Freestone, C Streck, pp. 248–271. Oxford, UK: Oxford Univ. Press.

Michaelowa, K., & Michaelowa, A. (2017). The growing influence of the UNFCCC Secretariat on the Clean Development Mechanism. *International Environmental Agreements* 17, 247–269.

Schneider, L., & Kollmuss, A. (2015). Perverse effects of carbon markets on HFC-23 and SF6 abatement projects in Russia. *Nature Climate Change* 5:12, 1061–1063.

World Bank. (2021). *State and Trends of Carbon Pricing 2021*. Washington, DC: World Bank.

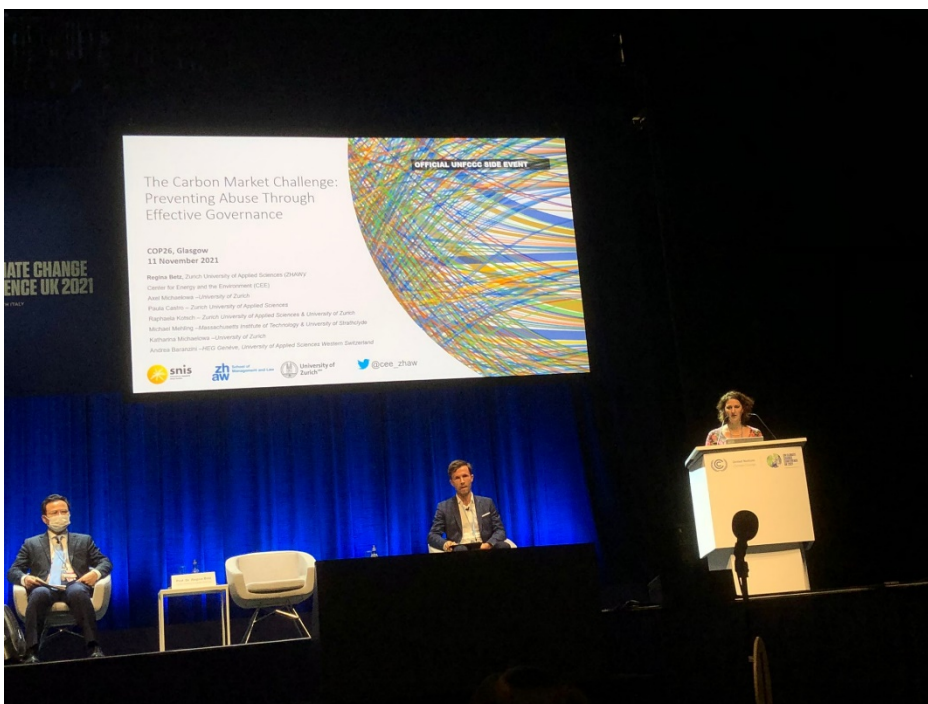
4. Output and Impact Report

4.1 Output Statement

Organized events

- **Official side event at COP 25 in Madrid, Tuesday 3 December 2019: “Generating trust in carbon markets: Insights from academic research”**
 - The side event presented research on the principles that should guide an international carbon market. Based on experiences with the Kyoto mechanisms and regional ETS, the event explored approaches to generate trust and to guard the integrity of the market mechanism under the Paris Agreement.
 - Speakers: Prof. Dr. Michael Mehling (MIT), Dr. Axel Michaelowa (University of Zurich and Perspectives), Raphaela Kotsch (University of Zurich / Zurich University of Applied Sciences), Gilles Dufrasne (Carbon Market Watch), Christoph Bals (Germanwatch)
- **Side event at European Pavilion in COP 25 in Madrid, Tuesday 3 December 2019: “Ensuring credibility of Article 6 as a means to promote ambition in climate change mitigation”**
 - Based on the experiences with the Kyoto mechanisms and regional ETS, the event explored approaches to generate trust and to guard the integrity of the market mechanism under the Paris Agreement. We discussed key market and regulatory challenges of the past and presented our research on principles and provisions that should guide an international carbon market such that Parties raise their ambition through international cooperation.
 - Speakers: Ms Beatriz Yordi (European Commission Director for European and International Carbon Markets), Dr. Axel Michaelowa (University of Zurich & Perspectives Climate Group), Prof. Dr. Michael Mehling (Massachusetts Institute of Technology), Raphaela Kotsch (University of Zurich & Zurich University of Applied Sciences), Nicolas Kreibich (Wuppertal Institute), Jürg Füssler (INFRAS), Derik Broekhoff (Stockholm Environment Institute)
- **Exhibit at COP 25 in Madrid, 6-7 December 2019**
 - The project team was assigned a booth with screen, where we were able to showcase the first publication resulting from the SNIS project. The booth allowed interested people to get in touch with us and to get informed about ongoing research. We showed the project’s video to interested persons.
- **Official side event at COP 26 in Glasgow, Wednesday 10 November 2021: “Article 6 readiness and CDM transition – key pillars of NDC implementation”**
 - Rapid transition of CDM is important to prevent a ‘valley of death’ before Art. 6 cooperation can start. At the same time, stringent regulation of carbon markets and cooperative approaches is key for environmental integrity. Capacity building is therefore key to generate Article 6 readiness, particularly in the context of NDC implementation plans. The event discussed forward-looking approaches, was held onsite at COP 26 and livestreamed via YouTube.

- Speakers: Dr. Axel Michaelowa (University of Zurich & Perspectives Climate Group), Mr. Pham Van Tan (Department of Climate Change, Government of Vietnam), Prof. Dr. Regina Betz (Zurich University of Applied Sciences), Stephan Hoch (Perspectives Climate Change), Mr. Nguyen Thanh Cong (Department of Climate Change, Government of Vietnam), Dr. Karen Holm Olsen (UNEP and Technical University of Denmark), Philipp Censkowsky (Perspectives Climate Group), Dr. Arunabha Ghosh (Council on Energy, Environment and Water India).
- The presentations can be downloaded from: https://seors.unfccc.int/applications/seors/attachments/get_attachment?code=IUPWY5YYOSVXGPXHS9WOAA53SBSWG7QY.
- YouTube link: <https://www.youtube.com/watch?v=IHMIMT53abo>



Fotos of side event at Glasgow Climate Conference, November 2021

Presentations at conferences, workshops and other events

- “Transfers of Kyoto units in the Swiss Emissions Trading Registry”, presented by Regina Betz at the International Association of Energy Economics (IAEE) European conference, August 2019, Ljubljana, Slovenia.
- “Transfers of Kyoto units in the Swiss Emissions Trading Registry”, presented by Regina Betz at the Artificial Intelligence in Industry and Finance, September 2019, Winterthur, Switzerland.
- “The role of non-liable entities in carbon markets on national and international level”, presented by Regina Betz at RSERC, December 2019, Humboldt University.
- “Market behaviour, market abuse and effective regulation: Evidence from carbon markets” presented by Raphaela Kotsch at a joint UZH-ETH PhD workshop on development economics in November 2019, Zurich.
- Raphaela Kotsch presented the research design for her dissertation on “Market behaviour, market abuse and effective regulation: Evidence from carbon markets” at the PhD Colloquium of the Centre for Comparative and International Studies in October 2019. The research design was accepted by the PhD Committee.
- Second video on the SNIS Project in German was produced and screened at the ZHAW Hochschultag in Wädenswil, which was attended by around 100 people, November 2019.
- “Die Rolle der Schweiz im internationalen Emissionshandel”, presented by Raphaela Kotsch at the Energieforschungsgespräche, January 2020, Disentis.
- “Using quantitative text analysis to measure countries’ negotiation positions on carbon markets under the Paris Agreement”, presented by Paula Castro and Raphaela Kotsch at the 2020 Annual Congress of the Swiss Political Science Association, February 2020, University of Lucerne.
- “CO₂-Handel bei Netto-Null Emissionen – was lässt sich da noch handeln”, presented by Regina Betz at the Energieforschungsgespräche, January 2021, Disentis.
- “Towards net zero: Dynamic baselines for international market mechanisms”, presented by Axel Michaelowa at the 2021 Annual Congress of the Swiss Political Science Association, February 2021, online.
- “The end of the Kyoto Protocol era: What can we learn from the global trade of emissions reduction units applying network analysis?”, presented by Raphaela Kotsch at the Annual Conference of the European Association of Environmental and Resource Economists (EAERE), June 2021, online.
- “The end of the Kyoto Protocol era: What can we learn from the global trade of emissions reduction units applying network analysis?”, presented by Raphaela Kotsch at the International Conference of the International Association for Energy Economics (IAEE), June 2021, online.
- “Oversight of carbon markets”, presented by Regina Betz at ICAP ETS Training And Capacity Building, July 2021, online [Oversight of Carbon Markets | ETS Training and Capacity Building \(icap-training.eu\)](https://icap-training.eu).
- “Using quantitative text analysis to measure countries’ negotiation positions on carbon markets under the Paris Agreement”, presented by Paula Castro and Raphaela Kotsch

at the 5th International Conference on Public Policy, July 2021, Barcelona (virtual participation).

- “Explaining country positions on carbon markets in climate negotiations”, presented by Paula Castro and Raphaela Kotsch at the European Consortium of Political Research (ECPR) General Conference 2021, September 2021, online.
- Poster presentation “The end of the Kyoto Protocol era: What can we learn from the global trade of Emissions Reduction Units applying network analysis?” by Raphaela Kotsch at Freiberg Autumn School in September 2021, in person.
- “Explaining country positions on carbon markets in climate negotiations”, presented by Paula Castro and Raphaela Kotsch at the Annual Meeting of the American Political Science Association (APSA), October 2021, Seattle (virtual participation).
- “Quantitative text analysis methods to explain country positions on carbon markets in climate negotiations”, presented by Paula Castro and Raphaela Kotsch at the Climate and Energy Seminar of the Potsdam Institute for Climate Impact Research (PIK), October 2021, online.
- “The carbon market challenge: Preventing abuse through effective governance”, presented by Regina Betz at the 7th Annual Conference on the Economic Assessment of European Climate Policies by the Florence School of Regulation (FSR), November 2021, online. [FSR Climate Annual Conference 2021 - Florence School of Regulation \(eui.eu\)](https://www.fsr.eu/en/annual-conference-2021)

Educational material

- Video explaining the content of the SNIS project and including some early findings, with 1395 views up to 16 November 2021 (<https://www.youtube.com/watch?v=YLZqq0NTSXU>, also accessible through the SNIS project website)
- Blog article “Die ZHAW an der UN-Klimakonferenz in Glasgow”, written by Regina Betz and commenting on the main outcomes of the conference and on our contributions in the area of carbon markets research (<https://blog.zhaw.ch/forschungssupport/die-zhaw-an-der-un-klimakonferenz-in-glasgow/>)

Articles in peer-reviewed journals

- Axel Michaelowa, Lukas Hermwille, Wolfgang Obergassel & Sonja Butzengeiger (2019): Additionality revisited: guarding the integrity of market mechanisms under the Paris Agreement. *Climate Policy* 19(10): 1211-1224, DOI: 10.1080/14693062.2019.1628695 (open access).
- Axel Michaelowa, Igor Shishlov & Dario Brescia (2019): Evolution of international carbon markets: lessons for the Paris Agreement. *WIREs Climate Change* 10(6): 613, DOI: 10.1002/wcc.613.
- Michael Mehling (2020): Governing Cooperative Approaches under the Paris Agreement. *Ecology Law Quarterly* 46(3): 765, DOI: 10.15779/Z389G5GD97.
- Rainer Baisch & Rolf H. Weber (2020): Regulatorische Herausforderungen im Emissionshandel. *Jusletter*: 13. Januar 2020.

Book manuscript

- Regina Betz, Axel Michaelowa, Paula Castro, Raphaela Kotsch, Michael Mehling, Katharina Michaelowa & Andrea Baranzini: *The Carbon Market Challenge: Preventing Abuse Through Effective Governance*. Manuscript under review at Cambridge University Press for its Cambridge Elements Series on Earth System Governance.

Working papers

- Axel Michaelowa, Katharina Michaelowa, Lukas Hermwille & Aglaja Espelage (2021): *Towards net zero: Dynamic baselines for international market mechanisms*. CIS Working Paper No. 107. Zurich: Center for Comparative and International Studies, ETH and University of Zurich.
- Paula Castro & Raphaela Kotsch (2021): *Quantitative text analysis methods to explain country positions on carbon markets in climate negotiations*. Conference paper.
- Raphaela Kotsch, Regina Betz, Peter Schwendner & Jan Abrell (2021): *The end of the Kyoto Protocol era: What can we learn from the global trade of Emission Reduction Units applying network analysis?* Conference paper.
- Rainer Baisch (2021): *The Future of Offsetting Carbon Emissions in the Aviation Industry*. Working paper.
- Rainer Baisch and Michael Mehling (forthcoming): *Carbon Market Oversight and the Role of Financial Market Regulation*. Working Paper.

Policy briefs

- Policy Brief: Preventing carbon market abuse through effective governance. ZHAW: November 2021. Available at: <https://www.zhaw.ch/en/sml/institutes-centres/cee/newsdetail/event-news/policy-brief-on-preventing-carbon-market-abuse-through-effective-governance/>
- Regina Betz & Paula Castro: Carbon markets in a net-zero world: A policy brief. *Global Cooperation Research – A Quarterly Magazine*: November 2021. Available at: <https://www.gcr21.org/publications/gcr/gcr-quarterly-magazine/qm-3-4/2021-articles/qm-3-4-2021-betz-and-castro-carbon-markets-in-a-net-zero-world-a-policy-brief>

4.2 Impact Statement

The work is relevant for the international climate change negotiations, particularly for discussion on implementing the international carbon markets under Article 6 of the Paris Agreement. The final text agreed upon in Glasgow includes some language which relates to the concept of ambition factor, presented in the working paper by Axel Michaelowa 2021 (see above). That's why it has been presented at side events during the negotiations at the Climate Conferences in Madrid in December 2019 and in Glasgow in December 2021.

It is also relevant for planned reforms of existing carbon markets and for the design of new ones. The EU ETS, for example, is currently being revised. Through her presentation at the 7th Annual Conference on the Economic Assessment of European Climate Policies, which

was attended by more than 70 researchers and policy makers involved in the design of the EU ETS and the incoming EU “Fit for 55” package, Regina Betz shared the main lessons for cap-and-trade markets that we gained from the project and thus provided insights for this process too.

In addition, we believe that the video that we produced in the framework of the project, as well as the interviews that we recorded among country delegates negotiating carbon markets under the Paris Agreement can be useful in educating the public and students about the promises and risks of carbon markets. Both the video and some of the recorded interviews have been used frequently by members of the project in their teaching and outreach activities (master, bachelor, executive training courses) as well as by other academics e.g. Humboldt University of Berlin. The video was played more than 1.400 according to the YouTube statistics.

