International Carbon
Action Partnership

CARBON LEAKAGE AND DEEP DECARBONIZATION

FUTURE-PROOFING CARBON LEAKAGE PROTECTION

SUMMARY FOR POLICYMAKERS

June 2020. Berlin, Germany

William Acworth; Christopher Kardish; Kai Kellner, International Carbon Action Partnership Secretariat

June 2020

Summary for policymakers

To avoid the most severe social, economic, and environmental impacts of climate change, the parties to the Paris Agreement committed to keep global warming to well below 2 degrees Celsius above pre-industrial levels and pursue efforts to limit the temperature increase to 1.5 degrees Celsius. To achieve this goal, policymakers will face new challenges in balancing efforts to transition to a competitive, low-carbon economy with short-term economic and social pressures that arise from increasing carbon prices in the face of differences in the stringency of domestic climate policy.

When it comes to carbon pricing and emissions trading, in particular in the absence of a global carbon market, differences in prices for emission allowances give rise to concerns about carbon leakage and a loss of competitiveness for domestic firms in jurisdictions with robust carbon pricing. This can result in shifting emissions and production abroad as domestic firms lose market share to foreign competitors that face fewer constraints on their emissions. Carbon leakage thereby presents both environmental concerns and potential economic, social, and political challenges. To date, all jurisdictions that have implemented an emissions trading system (ETS) have done so with provisions to protect against carbon leakage, in particular for emissions-intensive, trade exposed (EITE) industries. These EITE sectors are typically evaluated for vulnerability to carbon leakage using standardized criteria and given at least a portion of their required allowances free of charge. However, the future longevity of such an approach will be constrained by at least three factors:

1. **Declining allowance budgets in line with carbon neutrality (net-zero targets)**: as mitigation efforts scale up and caps decline, the quantity of allowances that can be allocated for free will also decline, constraining ongoing free allocation as the primary carbon leakage response in the long term. This will be particularly acute in systems where industrial emissions account for a sizeable share of the allowance cap.

2. **The impact of free allocation on investments, innovation, and downstream mitigation options**: as domestic emission targets align to carbon neutrality, it will be essential that carbon prices incentivize both the production and consumption of cleaner alternatives to emissions-intensive products and provide a credible framework for low carbon investments.

3. **A changing carbon pricing landscape**: as more jurisdictions pursue carbon pricing to achieve their climate targets it will become increasingly important to reassess leakage protections in light of carbon costs at play among major trading partners to ensure those provisions are sufficiently targeted based on actual leakage risk.

Against this backdrop, this paper considers the decarbonization challenge for basic industrial materials and develops a conceptual framework for assessing the compatibility of carbon leakage provisions in driving deep decarbonization as well as alternative approaches to measuring and addressing the risk of leakage. These industrial commodities, typically classified as EITE, face unique abatement challenges while accounting for a sizable portion of global emissions and increasing demand in the coming decades.

Carbon pricing and deep industrial decarbonization

While significant decarbonization of the electricity sector has begun, emission reductions from industrial sectors to date have been limited (Neuhoff et al., 2018; Le Quere et al., 2018; Marcu et al., 2019). This is concerning, particularly given the contrast between the abatement efforts required and the growing global demand for basic materials from industrial sectors (e.g. cement, iron and steel, aluminum, plastics) that is required for global economic and social development (IEA, 2019a). The production of basic materials accounted for around 22% of global CO2 emissions in 2016 (Bataille, 2019), while demand is estimated to increase two-to fourfold over the course of this century (Material Economics, 2018). Delivering emission reductions from these sectors faces three key challenges:

1. high energy demand for production processes with limited opportunities for electrification (indirect emissions);
2. greenhouse gases (GHGs) produced through chemical transformations during the production process (process emissions); and
3. GHGs emitted through decay or incineration of the material at the end of its life.

Because of these challenges, deep decarbonization of basic industrial materials will require measures on both the supply and demand sides, as illustrated in Table S.1 and discussed at length in chapter two of this report. To illustrate how critical both sides of this equation are, one recent study estimates that over 50 percent of the reduction challenge in the European Union (EU) can be achieved by reducing demand and consuming materials more efficiently (Material Economics, 2018).

Table S. 1.: Mitigation opportunities from the industrial sectors

Supply		Demand	
Fuel switching and production efficiency	**Innovations in the production process**	**Material substitution**	**Low carbon consumption**
• Low to medium heating through renewables • Replacing the fossil fuel feedstock with sustainably produced biomass • Increasing the efficiency of production	• Incremental improvements in existing technologies • New low carbon production processes • Carbon capture and storage • Negative emission technologies	• Increased recycling • Improved (intermediate) production processes	• Substituting low carbon alternatives for high carbon materials • Higher end use of products • Improved product design

Source: based on Neuhoff et al., 2018; Material Economics, 2018; ETC, 2018

Free allocation as an approach to leakage protection

Free allocation of various forms has helped mitigate the risk of carbon leakage. **Grandparenting**, **fixed baseline period benchmarking**, and **output-based allocation** (OBA) present different advantages and disadvantages when evaluated against our framework. The bulk of chapter three focuses on these different methods of allocation as they relate to leakage and abatement incentives. Going forward, systems of ongoing free allocation will face several challenges. While the carbon leakage risk criteria determine the sectors eligible for free allocation, the total volume of allowances available is ultimately determined by the allowance cap as well as any mandated auctioning share. As ETSs move to more ambitious cap-reduction paths over this decade and the next, the total number of allowances available for leakage protection will decline.

This tension is acute for systems where industrial emissions make up a significant share of the allowance budget. Systems with an economy wide cap, where industrial emissions are a small share of the allowance budget, are unlikely to face allowance shortages. However, given cap adjustment factors built into free allocation formulas, industrial producers will face increasing carbon costs if mitigation does not keep pace with declining volumes of free allocation.

The question then becomes whether those sectors at risk of carbon leakage can reduce their emissions in pace with declining free allocation budgets or whether, at some point, they will be exposed to increasing carbon costs and hence leakage risk. This challenge will be exacerbated in cases where the rules determining free allowance allocation threaten to distort deep decarbonization in these sectors. Addressing this concern will depend largely on where abatement opportunities lie for different industrial sectors and whether the allowance price, as mediated by the free allowance allocation approach, will trigger the necessary reductions. For sectors where abatement potential depends on innovation in product processes and demand response to higher product prices, there is substantial risk that they will not be equipped to reduce their emissions sufficiently under current policy settings.

Assessing carbon leakage risk

As the volume of allowances available for assistance becomes scarcer, it is essential that leakage risk assessment limits the number of sectors receiving allowances freely, hence reducing distortions and preserving the budget for those that need it most. This in turn requires reviewing current practices of assessing leakage risk, which is a major focus of chapter four. Currently, jurisdictions implementing unilateral carbon pricing have determined sectors eligible for protections from carbon leakage using two criteria. **Emissions intensity** is designed to capture the direct and indirect costs of carbon pricing and is measured by volume of emissions per unit of output, revenue, value-added, or profit. **Trade intensity** aims to capture the capacity of a regulated firm to pass through the costs of carbon pricing to customers without losing profit or market share to international competitors. It is often measured by the total volume of imports and exports of a product relative to imports and domestic production. EITE criteria have performed reasonably well in balancing tradeoffs between accuracy, administrative complexity, and consistency. However, across most systems this has resulted in a rather broad application of leakage protection provisions.

We have considered two responses to this challenge. The **first possible approach** is to adapt the carbon leakage risk criteria to better reflect actual risk and in doing so restrict the number of sectors that receive free allocation. However, based on a detailed assessment of the literature there is no clear choice of additional criteria that could be applied alongside existing EITE criteria to improve broad leakage assessment. Additional criteria come with caveats that would increase the complexity of leakage risk assessment, require significant additional data, and at times reduce the transparency of the approach. Furthermore, the provision of additional tests may also open alternative grounds for industry to inappropriately claim leakage risk, as they could choose from the most advantageous indicators.

Given these drawbacks, a **second possible approach** is adjusting the emissions and trade intensity thresholds for leakage protection. One model could be to increase the emissions-intensity and trade-intensity thresholds for qualification such that only those deemed to be of "high" risk qualify automatically. A more complex assessment with a wider range of criteria could then be applied to sectors at lower risk levels. The benefits of such an approach would need to be considered against the costs in terms of increased administrative complexity and reduced transparency. Another way to work with existing criteria would be to continue exclusively using EITE criteria but assigning different thresholds to different tiers (e.g. low, medium, and high) and giving each tier different levels of free allocation. California and Québec use such a tier-based approach, but both apply 100% assistance factors to all EITE entities at the benchmark level regardless of risk classification, though Québec will start differentiating assistance factors between 90-100% based on risk classification from 2021-2023 (assistance factors after that time have not yet been decided). In California, 100% assistance factors are required through 2030 by legislation. Total levels of free allocation in California and Québec will, however, continue to decline based on declining cap adjustment factors.

Alternative approaches to address carbon leakage

Adjustments to the carbon leakage risk criteria may prolong free allocation budgets. However, ongoing free allocation may not be sufficient to support industries to decarbonize in pathways consistent with net zero. Two options that could replace or work alongside free allocation and are explored in chapter five include border carbon adjustments (BCAs) and consumption charges. Both would present new administrative and political challenges, as well as potential trade distortions, but both alternatives would likely unlock abatement opportunities.

BCAs apply tariffs or other measures to imported goods based on their embedded GHG emissions and/or rebates for domestic exports to markets that have not established comparable constraints on their emissions. Their application would require balancing their effectiveness against leakage with World Trade Organization (WTO) compliance and administrative feasibility. An ETS jurisdiction considering BCA may consider engaging both with the WTO for greater clarity on the legal dimensions and with trading partners in bi- or -multilateral discussions on its plans before adoption. An analysis of the academic literature[1] and existing proposals suggests some guidelines or principles for jurisdictions considering a BCA.

[1] A comprehensive view of design elements is provided by, for example Mehling et al. (2017), Carbon Trust (2010), Cosbey et al. (2012), Mehling et al. (2019), and Cosbey et al. (2019).

- **A BCA that is narrow in scope – at least at the beginning – is likely more administratively and legally feasible**: Limiting an initial BCA to only the most vulnerable EITE sectors and only imports may help balancing the trade-offs in BCA design.
- **Different scopes of coverage may be appropriate for different sectors**: Leakage protections will vary sector by sector, depending on factors such as trade intensity. For some a BCA that only adjusts for overseas exports entering the implementing jurisdiction will capture much of the benefits. A BCA offering only rebates or exemptions for domestic production to overseas markets could be appropriate for some sectors in terms of leakage protection but remains relatively unexplored in the academic literature and would present significant drawbacks.
- **Covering both direct and indirect emissions would improve the scheme's effectiveness and may be administratively and legally feasible**: Including both direct and indirect emissions would likely improve the effectiveness of the BCA but would require multiple benchmarks and greater clarity from the WTO about legal ramifications if the implementing jurisdiction does not explicitly cover indirect emissions in its carbon-pricing system.
- **Benchmarks on direct emissions based on the implementing jurisdiction's production are likely more administratively and legally feasible**: Setting benchmarks of emissions intensity on which to base the adjustment for products included in the BCA will likely be necessary for legal reasons. Administrative and legal challenges will likely preclude setting benchmarks based on the average emissions intensity of each exporting country individually, as country-specific determinations are more likely to be considered discriminatory under WTO rules, or basing the adjustment on the actual verified emissions of each importer.
- **It may be advisable to avoid country-specific benchmarks on indirect emissions as well**: For similar reasons, benchmarks for indirect emissions that avoid country-specific determinations are likely easier administratively and legally. Region-specific benchmarks might help in these regards and offer a more effective response than a benchmark based on the implementing jurisdiction.
- **Phasing out free allocation is critical to unlocking the abatement incentives of BCA, but a transition period may be useful, especially to help secure industry support**: Continuing free allocation would mean removing the value of allowances from the border adjustment, but a transition approach may help alleviate concerns of the industries covered under the scheme. It may also mitigate concerns of trade partners by reducing the adjustments they would face at the beginning.

Enacting charges on the consumption of industrial materials while maintaining output-based allocation for producers may offer a promising alternative to BCA that would significantly improve abatement incentives on the demand side of the industrial value chain compared to free allocation alone.[2] While BCAs aim to capture the cost of emissions in the production of goods, consumption charges aim to restore prices signals on the use of goods. No jurisdiction has implemented consumption charges on carbon-intensive industrial materials, but consumption charges have been implemented on other emissions-intensive activities or products, such as fossil fuels and electricity generation.[3] Here we focus on consumption charges applied in a

[2] For a more detailed understanding of policy design, see Neuhoff et al. (2016) and Ismer et al. (2016).
[3] See Munnings et al. (2016) and Raffaty and Grubb (2018) for an overview of other consumption charges.

system of free allocation, where they would be designed to pass on carbon costs that are otherwise blunted through leakage provisions.

Domestic firms from sectors covered by the consumption charge would have to report their production volumes and would be held liable for the consumption charges due. Producers would either pay the charges themselves or reflect the charges in their pricing at the point of sale for intermediate consumption. Duty-suspension arrangements provide an option for qualifying firms to forego consumption charges if their materials or the subsequent product will be exported. The liability for imported materials subject to consumption charges would be equivalent. Ensuring compliance would require integrating the liability for relevant product categories in the implementing jurisdiction's existing tariff system and establishing accounting and reporting systems that are not overly burdensome relative to obligations for domestic producers.

As an internal charge resembling a value-added tax assessed on domestic production and imports alike using the same product benchmark, consumption charges may prove more robust to WTO challenges than BCA, depending on the BCA's design. They may also be administratively simpler, given that many jurisdictions already have extensive experience with value-added and excise taxes, along with the infrastructure to collect them. However, the extension of consumption charges to imports farther down the value chain that contain significant portions of covered materials would increase the administrative demands of the system, depending on inclusion thresholds and data availability. This potential for trade distortions farther down the value chain in response to unilateral leakage measures is a risk for BCA as well.

A key challenge with consumption charges is the scheme's leakage protections would depend on future levels of free allocation. If declining free allocation outpaces abatement from industrial sectors, continued discrepancies in carbon pricing among key trading partners could still trigger leakage risk. In that circumstance, jurisdictions implementing consumption charges may need to consider other means of industry compensation to fully guard against potential carbon leakage, make changes to the distribution of allowances to prioritize certain sectors, or transition to an instrument that levels differences in carbon costs among trading partners.

Furthermore, as price discrepancies are not levelled at the border, their potential to incentivize abatement outside of the implementing jurisdiction may be limited. Trading partners would have little reason to phase out free allocation if they would face consumption charges for their exports to a jurisdiction implementing consumption charges on top of their own domestic carbon price.

Additional policies supporting decarbonization

Deep industrial decarbonization will require additional policies beyond carbon pricing. In some instances, carbon prices may be below what is required to incentivize certain technologies and are subject to considerable uncertainty, while low-carbon investments for emissions-intensive industry are capital-intensive and come with long-term costs. The potential for investment offshoring that leads to leakage from a loss of long-term competitiveness also underscores the need for additional policies targeting emissions-intensive industries. These factors, compounded with the need for more innovation in breakthrough industrial technologies, underscore the need for additional supporting policies, which are explored in chapter six.

Subsidies to support the deployment and development of **low-carbon technologies** for industry are one way to address some of these problems. The market for low-carbon technologies in other sectors – particularly transport, buildings, and energy – is far more advanced than for heavy industry, owing to more concerted government policies spanning decades (Åhman et al., 2017; IEA, 2019b). Growing awareness of these challenges is leading to greater policy focus. For example, the EU ETS Innovation Fund will prioritize demonstration projects for industrial sectors for the first time starting 2021, and InvestEU envisions supporting successful projects from the Innovation Fund to scale up. Québec plans to combine reductions in free allocation with dedicated funding to support mitigation for EITE entities (ICAP, 2020), along with significant additional budgetary support for industrial decarbonization. The EU is also considering placing conditions on indirect cost compensation for Phase IV of the EU ETS that would require additional investment in low-carbon technologies and production processes to receive aid (European Commission, 2020).

A policy more squarely aimed at deployment of promising technologies are **carbon contracts for difference** (CCfDs). CCfDs offer a way to reduce risk in capital-intensive projects by effectively guaranteeing a certain return for the incremental costs of an investment that delivers emissions reductions below the current best available technology. As developed by Richstein (2017), CCfDs pay out the difference between a reference price (e.g. the yearly average allowance price) and a price agreed to in the contract, effectively guaranteeing a certain level of revenue for the incremental costs of the investment (see also Neuhoff et al., 2019, and Sartor & Bataille, 2019). If the reference price exceeds the contract price, the investor would pay back the difference.

Product carbon requirements (PCRs) may be another tool that would incentivize both greener consumption and production, especially if the standards were made mandatory after an initial voluntary phase. PCRs for industrial commodities have not been extensively studied[4] but in essence would begin with labelling standards for certain industrial products linked to their emissions intensity, starting on a voluntary basis initially. In a second phase, the implementing jurisdiction could establish mandatory PCRs that would limit the sale of basic materials to those that meet a certain threshold of emissions intensity. Such an approach would likely only take place in the later stages of an industrial decarbonization process, once there is enough capacity to produce low-carbon materials.

Each of these policies would come with varying challenges, whether trade-based in the case of product carbon requirements or raising equity concerns in the case of CCfDs, which would require significant amounts of capital made available to industrial sectors. But given the scale of the challenge, particularly on technology, they warrant further consideration.

[4] For the most extensive proposal to date, see Gerres et al., (2019)

References

Åhman, M., Nilsson, L. J., & Johansson, B. (2017). "Global climate policy and deep decarbonization of energy-intensive industries." *Climate Policy*, 17(5): 634-649.

Bataille, C. (2019). "Physical and policy pathways to net-zero emissions industry". *Wiley Interdisciplinary Reviews: Climate Change,* 11(2), 633.

Carbon Trust (2010). "Tackling carbon leakage: sector-specific solutions for a world of unequal carbon prices." Retrieved from: https://www.carbontrust.com/resources/tackling-carbon-leakage-sector-specific-solutions-for-a-world-of-unequal-prices

Cosbey, A., Dröge, S., Fischer, C., Reinaud, J., Stephenson, J., Weischer, L., & Wooders, P. (2012). "A Guide for the Concerned: Guidance on the elaboration and implementation of border carbon adjustment." Retrieved from: https://www.iisd.org/sites/default/files/publications/bca_guidance.pdf

Cosbey, A., Dröge, S., Fischer, C., & Munnings, C. (2019). "Developing guidance for implementing border carbon adjustments: Lessons, cautions, and research needs from the literature." *Review of Environmental Economics and Policy,* 13(1): 3-22.

Energy Transitions Commission (ETC). (2018). "Mission Possible: reaching net-zero carbon emissions from harder-to-abate sectors by mid-century." Retrieved from: http://www.energy-transitions.org/sites/default/files/ETC_MissionPossible_FullReport.pdf

European Commission (EC) (2020). "Explanatory note accompanying the proposal for the revision of the Emission Trading System Guideline." Retrieved from: https://ec.europa.eu/competition/consultations/2020_ets_stateaid_guidelines/explanatory_note_en.pdf

Gerres, T., Haussner, M., Neuhoff, K., & Pirlot, A. (2019). "Can Governments Ban Materials with Large Carbon Footprint? Legal and Administrative Assessment of Product Carbon Requirements." *DIW Discussion Papers*, No. 1834, DeutschesInstitut für Wirtschaftsforschung (DIW), Berlin.

International Carbon Action partnership (ICAP). (2020). Emissions Trading Worldwide: Status Report 2020. Berlin: ICAP.

International Energy Agency (IEA). (2019a). "Material Efficiency in Clean Energy Transitions." International Energy Agency. Paris.

Le Quéré, C., Andrew, R. M., Friedlingstein, P., Sitch, S., Hauck, J., Pongratz, J., ... & Arneth, A. (2018). "Global carbon budget 2018." *Earth System Science Data (Online)*, 10(4).

International Energy Agency (IEA). (2019b). "Tracking clean energy progress: assessing critical energy technologies for global clean energy transitions." International Energy Agency. Paris. Retrieved from: https://www.iea.org/topics/tracking-clean-energy-progress

Ismer, R., Haussner, M., Neuhoff, K., & Acworth, W. W. (2016). "Inclusion of Consumption into Emissions Trading Systems: Legal Design and Practical Administration." *DIW Discussion Papers*, No. 1579, Deutsches Institut für Wirtschaftsforschung (DIW), Berlin.

Marcu, A., Alberola, E., Caneill, J.-Y., Mazzoni, M., Schleicher, S., Vailles, C., Stoefs, W., Vangenechten, D., & Cecchetti, F. (2019). "2019 State of the EU ETS Report." Retrieved from: https://www.i4ce.org/wp-core/wp-content/uploads/2019/05/2019-State-of-the-EU-ETS-Report-1.pdf

Material Economics (2018). "The Circular Economy – A Powerful Force for Climate Mitigation: Transformative Innovation for Prosperous and Low-Carbon Industry." Retrieved from: https://media.sitra.fi/2018/06/12132041/the-circular-economy-a-powerful-force-for-climate-mitigation.pdf

Mehling, M. A., van Asselt, H., Das, K., Droege, S., & Verkuijl, C. (2017). "Designing Border Carbon Adjustments for Enhanced Climate Action." *DIW Discussion Papers*, No. 1579, Deutsches Institut für Wirtschaftsforschung (DIW), Berlin.

Mehling, M. A., van Asselt, H., Das, K., Droege, S., & Verkuijl, C. (2019). "Designing border carbon adjustments for enhanced climate action." *American Journal of International Law*, 113(3): 433-481.

Munnings, C., Acworth, W., Sartor, O., Kim, Y. G., & Neuhoff, K. (2016). "Pricing Carbon Consumption: a Review of an Emerging trend." *DIW Discussion Papers*, No. 1620, Deutsches Institut für Wirtschaftsforschung (DIW), Berlin.

Neuhoff, K., Chiappinelli, O., Bataille, C., Haußner, M., Ismer, R., Joltreau, E., ... & Singhal, P. (2018). "Filling gaps in the policy package to decarbonise production and use of materials." Retrieved from: https://climatestrategies.org/wp-content/uploads/2018/06/CS-DIW_report-designed-2.pdf

Neuhoff, K, Chiappinelli, O., Gerres, T., Haussner, M., Ismer, R., May, N., … & Richstein, J. (2019). "Building blocks for a climate-neutral European industrial sector." Retrieved from: https://www.diw.de/documents/dokumentenarchiv/17/diw_01.c.694700.de/cfmp_report_building_blocks_for_a_climate_neutral_european_industrial_sector.pdf

Neuhoff, K. et al. (2016). "Inclusion of Consumption of carbon intensive materials in emissions trading–An option for carbon pricing post-2020." *Climate Strategies*. Retrieved from: http://www.lse.ac.uk/GranthamInstitute/wp-content/uploads/2016/06/CS-Report.pdf

Raffaty, R., & Grubb, M. (2018). "Policy brief: how can consumption-based carbon pricing address carbon leakage and competitiveness concerns?". Climate Strategies. Retrieved from: https://climatestrategies.org/wp-content/uploads/2018/05/27916-CPLC-ExecBrief-CarbonPricing-v7.pdf

Richstein, J. C. (2017). "Project-Based Carbon Contracts: A Way to Finance Innovative Low-Carbon Investments." *DIW Discussion Papers*, No. 1714, Deutsches Institut für Wirtschaftsforschung (DIW), Berlin.

Sartor, O., & Bataille, C. (2019). "Decarbonising basic materials in Europe: How Carbon Contracts-for-Difference could help bring breakthrough technologies to market." IDDRI Study No. 06/19, IDDRI, Paris.

International Carbon Action Partnership