CARBON PRICING LEADERSHIP COALITION

Executive Briefing
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Climate Strategies

How can consumption-based carbon pricing address carbon leakage and competitiveness concerns?

THE RATIONALE FOR CONSUMPTION-BASED CARBON PRICING

Most carbon prices currently in existence are levied either upstream or midstream in the value chain, typically at power plants, refineries, processing plants, or industrial facilities. These domestic carbon-intensive producers are considered 'the emitters', and the emitters pay the carbon price. The rationale for this is the expectation that the emitters will be incentivized to find cleaner ways to carry on producing, while at the same time the price signal will pass further down the value chain and incentivize consumers to decarbonize. In practice, however, concerns about cross-border carbon leakage in emissions-intensive, trade-exposed industries have often led governments to grant carbon price exemptions or free allowance allocations. These have been linked to current or recent production activities and have muted the carbon price signal for both producers and consumers. This production-based approach to carbon pricing has been particularly ineffective at yielding emissions reductions in basic materials industries, such as cement, steel, and aluminum. It also has not provided governments with adequate policy tools to price extra-territorial emissions, such as those embodied in imports of electricity or emissions-intensive internationally traded goods.

KEY MESSAGES

- Pricing carbon consumption, rather than just production, can improve the economic efficiency and environmental effectiveness of carbon pricing schemes by ensuring that the costs of CO_2 emissions associated with production are fully passed through the entire value chain.
- A price on carbon consumption eliminates the risk of cross-border carbon leakage and incorporates extra-territorial emissions, since it treats producers on a level playing field regardless of their jurisdiction of origin.
- Governments in a number of jurisdictions — including California, China, Tokyo, and South Korea — currently operate carbon prices that regulate the consumption of CO_2 emissions associated with electricity and fuels, providing policy-relevant lessons.

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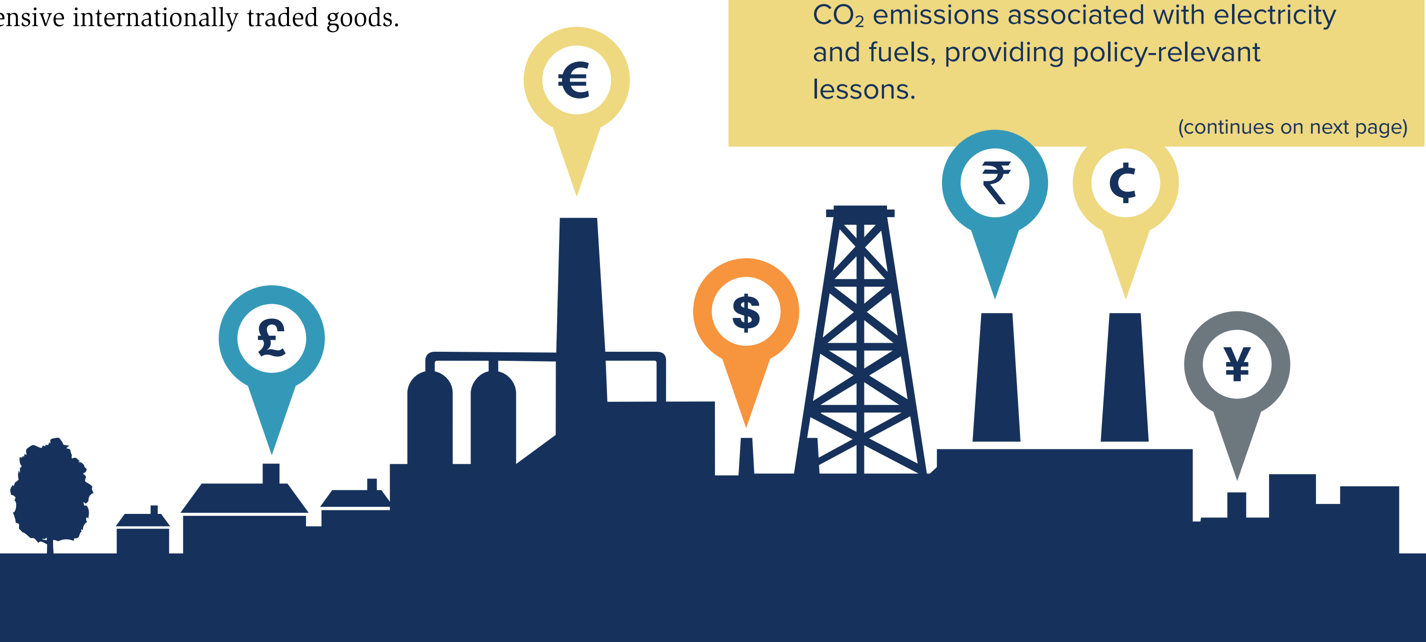


KEY MESSAGES (CONT.)

- There is a full spectrum of potential methods of applying the consumption-based price, ranging from: (1) international product-specific benchmarks that do not differentiate according to production method and location; to (2) product-specific labeling and declaration requirements that account for life cycle CO_2 emissions associated with different production processes. Each has different political, legal, environmental, and administrative implications, but initially an evolutionary approach that starts with undifferentiated benchmarks, and evolves towards full carbon-reflective pricing may be the optimal path forward.
- In the years ahead, consumption-based pricing could be integral to the challenge of decarbonizing value chains in emissions-intensive basic materials, such as cement, steel, and aluminum production, which are responsible for approximately 30 percent of global CO_2 emissions. However, there are sector-specific challenges to establishing product benchmarks, as well as in developing systems to monitor and verify the emissions associated with different modes of production.

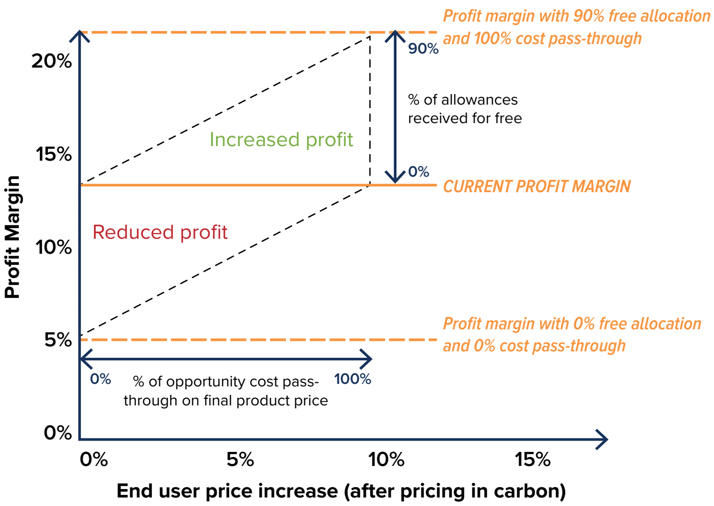
An alternative, or supplement, to the production-based approach is to price carbon further downstream nearer to the point of final consumption. Under this arrangement, those who pay the carbon price are retail electricity distributors, households, or businesses purchasing carbon-intensive energy or commodities, regardless of their jurisdiction of origin. Several key policy design challenges motivate the growing interest in pricing carbon at the point of consumption:

1. AVOIDING CARBON LEAKAGE IN EMISSIONS-INTENSIVE INDUSTRIES WITHOUT WEAKENING THE CARBON PRICE SIGNAL

Most industries in countries that price carbon have not faced significant competitive disadvantages for two reasons: (1) most emissions-intensive, trade-exposed sectors have been shielded by exemptions or free allowance allocations; and (2) the carbon prices that exist at present in over sixty jurisdictions have been fairly low, with approximately three-fourths of prices below $10 per tonne CO_2.[1,2] Partly as a result, the majority of industries have been able to simply accept the change and adapt, by reducing the carbon-intensity of production, passing through the remaining costs, and innovating towards full-fledged, low-carbon supply chains.[3,4,5] But if carbon prices in more jurisdictions are to rise to levels commensurate with the aims of the Paris Agreement, not all industries can so easily adapt. Certain basic materials sectors that are emissions-intensive and trade-exposed — e.g. steel, cement, and aluminum — are more at risk of production cost increases and a loss of competitiveness due to large regional disparities in carbon prices.[6] Unilateral carbon pricing comes with the risk of carbon leakage, whereby native emissions-intensive companies may choose to move operations or investment to foreign jurisdictions without a carbon price.[7] Not only would carbon leakage result in the loss of high value-added industries in countries with a carbon price, but it also means that emissions will still occur, and could even increase, by 'leaking' to places with weaker standards.

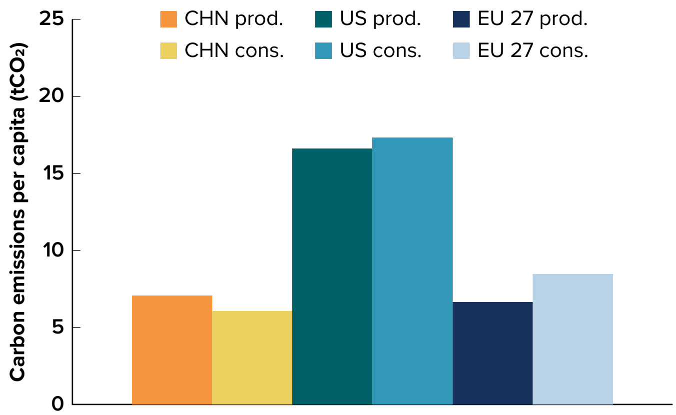
Producers rarely, if ever, want to reduce production of their own product; governments, too, are wary of intentionally reducing production in high value-added, export-oriented industries. This has led many governments to grant carbon-intensive materials sectors exemptions or free allowance allocations, thereby muting the carbon price signal across the value chain and reducing its environmental effectiveness. The EU ETS has been undergoing a series of reforms designed to reduce the surplus of allowances that amounted to two billion in 2015 (this corresponds to approximately one full year of allowed emissions under the cap), which had resulted in substantial windfall profits to large electricity and industrial firms and a persistently low carbon price (see Figure 1)[8]. Consumption-based carbon pricing, in its most generic form, can help to overcome the inefficiency inherent in such exemptions and free allocations by avoiding special treatment — all carbon flows would be treated at the point of consumption, regardless of place of origin.[9]

Figure 1: Dependence of profit margin on combination of free allocation and cost pass-through



Note: The numbers on the graph correspond to one of the most carbon-intensive products, namely steel produced by blast furnaces in Europe, at a carbon price of EUR 30/tCO_2, before international effects. The numbers are based on 2010 data and might have changed since then.
Source: Adapted from Grubb, Hourcade and Neuhoff (2014).

Figure 2: Production and Consumption-Based CO_2 emissions in China, the United States, and the European Union



Note: Data is for 2014 and comes from the Carbon-Cap Dataset. Since 2008, per capita consumption-based emissions have declined slightly in the U.S. and EU, but prior to that, they were on the rise even as per capita production-based emissions were relatively flat. Both indicators have increased in China since the late 1960s.[10]

Aside from the issue of exemptions and free allocations, the carbon price signal can also be undermined in certain oligopolistic or imperfectly competitive markets, wherein the retail price hikes to be expected from carbon pricing may be subdued. This kind of imperfect pass-through has been observed in China's electricity market, where retail prices are set in advance by government. Pricing carbon consumption can, in these kinds of imperfectly competitive markets, ensure that decarbonization incentives and substitution effects are activated across the value chain.

2. INCLUSION OF EXTRA-TERRITORIAL EMISSIONS

Carbon prices around the world currently apply almost exclusively to territorial emissions, excluding emissions associated with the foreign production of imported goods. This has made international climate mitigation efforts less effective than they could be. Even in regions with established carbon pricing initiatives and declining territorial emissions, such as the European Union, the overall carbon footprint has actually increased in certain years, when accounting for the (consumption-based) CO_2 emissions embodied in internationally traded goods (see Figure 2). A burgeoning strand of academic scholarship has called attention to the necessity of pricing not only territorial emissions, but also consumption-based emissions.

There has, however, been a striking absence of international dialogue about how to price extra-territorial emissions. Many policymakers have been risk averse to the political and legal challenges of implementing border carbon adjustments (BCAs), a prominent alternative to consumption-based carbon pricing. BCA is a generic term for a variety of proposals that levy a domestic carbon price on imports of selected products from jurisdictions that do not price carbon (sometimes including a rebate for exports), either through a border tax or by requiring importers to surrender a quantity of allowances under the jurisdiction's carbon market. BCAs share with consumption-based carbon pricing the purpose of avoiding carbon leakage in highly traded emissions-intensive industries, leveling the field between domestic and foreign producers, and also ensuring that an effective carbon price signal is passed on to consumers. While BCAs are potentially environmentally effective and WTO-compatible,[11,12] some policymakers still fear the risk of WTO litigation, whether or not those legal challenges would have merit.[13] Numerous jurisdictions have avoided BCAs due to their potential trade-related consequences, namely backlash from trading partners that view the move as heavy-handed and punitive, especially for developing countries. Some suggest that such a scenario could ultimately impair progress in multilateral climate negotiations.[14] But in some countries, such as the United States, BCAs have almost always been included in national carbon pricing proposals, since legislators have viewed it as a prerequisite that domestic producers will not be disadvantaged.

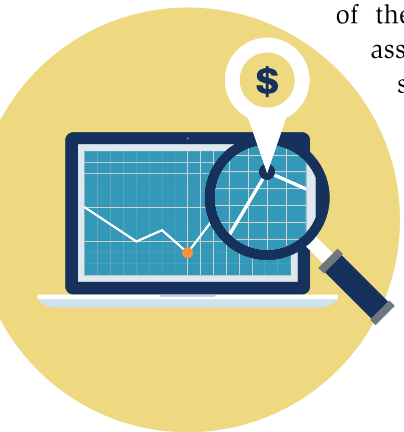
Consumption-based carbon pricing is a viable alternative approach. It can effectively price extra-territorial emissions by taking one of two main forms:

1. A simplified version, involving a uniform **sector-specific benchmark** that is used to calculate a consumption charge for selected products — e.g. a given volume of steel product or clinker, regardless of place of origin or production process.

2. A more developed version, involving mandatory **product labeling of life cycle CO_2 emissions** according to an international auditing standard. This option would involve differentiated consumption charges.

In reality these are extremes of what may be a range of options involving less or more differentiation based on how similar products are made. (1) is the simplest, with no reference to how a product was made. Consumption-based charging can become more directly carbon-reflective either by differentiating benchmarks according to production technologies (eg. between blast furnace vs electric arc-made steel) or by offering reductions to companies providing an audited trail to prove that product emissions are actually lower than the benchmark. (2) can be seen as the culmination, requiring full chain carbon accounting of products of interest.

These two options — and the range of intermediary options — are still distinct from BCAs in that they do not constitute a border tax adjustment, but instead, through different methods, they apply a carbon charge at the point of end-user consumption. They share with BCAs the purpose of pricing extra-territorial emissions, but avoid some of the political and legal difficulties associated with border-related measures. Nevertheless, each option comes with its own set of political, legal, and administrative challenges (see 'Technical and Administrative Considerations' below for further details).



3. EXPANDING CARBON PRICING TO MORE JURISDICTIONS

When a major market economy complements existing climate policies with a consumption-based carbon price (e.g. in the steel industry), steel producers in foreign jurisdictions without a carbon price that export to that market will no longer reap undue competitive advantages. Governments in these foreign jurisdictions may be induced to adopt a carbon price of their own, once it is recognized that the advantages of free riding have diminished, while at the same time other jurisdictions are raising significant carbon revenues on domestic sales that could be used for a variety of welfare-enhancing purposes. In other words, governments may begin to recognize the opportunity to raise carbon revenues without disadvantaging native producers, and opt to join the club of jurisdictions doing so. This could potentially produce a positive feedback loop and facilitate the spread of carbon pricing cross-jurisdictionally.[15]

4. JURISDICTIONAL AUTONOMY

In certain cases, sub-national (state, provincial, or municipal) policymakers may want to pioneer climate policies of their own, especially if the national government or neighboring states' efforts are laggard or insufficient. Consumption-based pricing enables cities and provinces to establish jurisdictional autonomy in this way. For example, since 2010, the municipal government of Tokyo has levied a city-level price on carbon consumption for electricity and fossil fuels that regulates building facilities, rather than electricity producers (see 'Policy Options and Real-World Examples' below). The motivating factor for this policy was twofold: First, Tokyo's electricity is sourced primarily from production facilities located outside of the prefecture, so pricing at the building-level ensures adequate regulation[16]; second, landlords and tenants face differing incentives from ownership and leasing, and consumption-based pricing at the point of building-owners is far more likely to effectively incentivize capital investments in retrofits and efficiency upgrades.[17]

TECHNICAL AND ADMINISTRATIVE CONSIDERATIONS

Any jurisdiction implementing a consumption charge on carbon will need to ensure the technical and administrative viability of the program. In doing so, policymakers should consider the appropriate coverage of particular industries, as well as how to appropriately monitor and differentiate between the carbon embodied in different products.

MAXIMIZING CLIMATE BENEFITS WHILE ENSURING EASE OF IMPLEMENTATION

Applying a consumption-based carbon price to thousands of highly differentiated products of varying importance to climate change is both administratively cumbersome and politically impractical. While economic theory suggests that an economy-wide carbon price at 100 percent coverage would make sense in the absence of transaction costs, in the real world this condition is clearly not met. Policymakers must decide if the marginal benefits of including additional emissions outweigh the marginal costs associated with monitoring, reporting and verification. It is therefore important to narrow the scope of coverage to products or materials whose coverage would have the greatest environmental benefit and ease of implementation.

In power and heating markets, there are only very specific instances in which a consumption-based charge might fare better than production-based approaches: (1) when large volumes of electricity are traded across borders, arriving from countries or jurisdictions that do not price carbon; or (2) in electricity or heating markets in which governments set retail prices, such as in China. For oil, consumption-based pricing may have more practical application, as in the case of already existing consumption charges on gasoline; it remains an open question whether governments would do best to price carbon at the oil well, refinery, or terminal rack, or further downstream at the gas station — the latter, it should be noted, avoids the need for border measures, but it may inadequately account for different levels of upstream, extraction-related emissions.

While climate change policymakers have begun by picking 'low-hanging fruit' in power markets, the most carbon-intensive industrial sectors have been more difficult to align with carbon pricing. Industry accounts for nearly one-third of global GHG emissions, and approximately 60–80% of industrial emissions arise from emissions-intensive production of basic materials: cement, iron and steel, aluminum, plastics, and just several other industries.[18] As previously noted, these sectors also face the greatest potential operating cost increases from carbon pricing and have had, as recipients of carbon tax exemptions and free allowances, inadequate incentive to drive technical low-carbon innovation and substitution.[19] Given these considerations, many jurisdictions will likely find that, aside from marginal applications in power and heating markets, consumption-based carbon pricing may be most powerfully applied to a small subset of the most carbon-intensive basic materials.

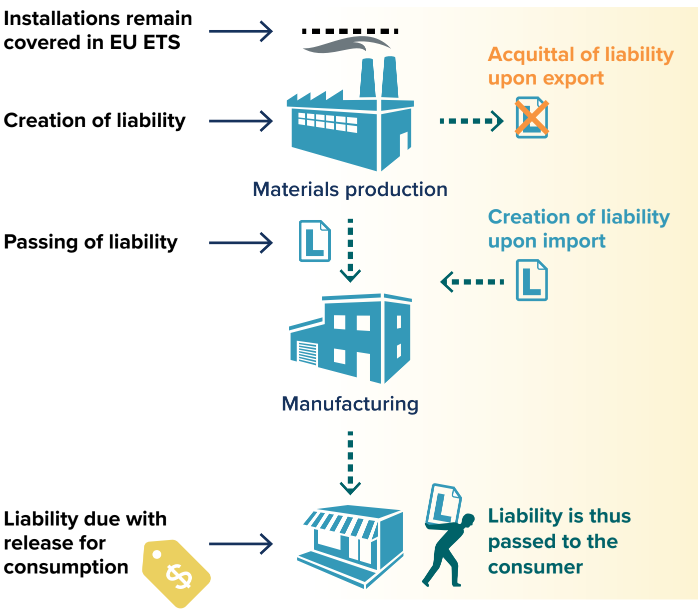
DISTINGUISHING BETWEEN PRODUCTS

In practice, the precise implementation of consumption charges will vary slightly according to whether the jurisdiction has a carbon tax or emissions trading system, but the basic principles are the same. A core set of sectors and products qualifying for the consumption charge will be liable according to embodied carbon content.

The most administratively straightforward way of determining liability for carbon content may be through a benchmark system (the first, simplified option noted above), based on best-available production standards used by top producers. Similar benchmarking is already currently employed in the EU ETS and other emissions trading systems. The benchmark would be used to calculate the consumption charge, based on the following inputs: (1) the volume of the material; (2) the product-specific benchmark value of CO_2 emitted directly and indirectly (i.e. from electricity) during production; and (3) the jurisdiction's carbon price, based on the average annual rate.[20] In practice, in an emissions trading system, a liability for a consumption charge is created from the point of production of carbon-intensive commodities, but the liability is passed on further downstream when it is sold as a product to a firm or consumer; the same liability is created when carbon-intensive commodities are imported, and would be rebated upon export (see Figure 3 for more details).

Numerous sector-specific details need to be settled when establishing consumption charges based on uniform benchmarks.[21] For cement, it is relatively simple to set benchmarks and determine the consumption charge according to 'best available technology' emissions. However, varying production methods of some other basic commodities imply different benchmarks, which raises the legal and practical question of whether jurisdictions adopting a consumption charge should attempt to differentiate between production methods. For steel for example, products would likely need to be distinguished based on whether they were produced with blast furnaces or electric arc, resulting in varying consumption charges. For aluminum, it is arguably important to distinguish based on the carbon-intensity of the electricity used to produce the product — aluminum made from low-carbon hydroelectricity in Norway or Iceland, for example, would likely need to be distinguished from aluminum produced by gas in Russia or coal in China. Setting a uniform industry-specific benchmark avoids this difficulty, and is partly for that reason fully WTO-compatible and consistent with Article III of the General Agreement on Tariffs and Trade (GATT),

Figure 3: Sample Illustration of Benchmark-Based Consumption Charges in the EU ETS



Note: Liability is based on the volume of the material, multiplied by the benchmark for the material.
Source: Neuhoff et al. (2016).[22]

since the carbon price applies to products and materials equally at the point of consumption, regardless of production method or location.[23] Yet, it also comes at the environmental cost of inadequately incentivizing upstream low-carbon innovation. To summarize, an undifferentiated benchmark is relatively easy to administer, but ultimately of very limited scope: (1) It only works for a very limited number of sectors (cement, and steel if policymakers contentiously ignore the difference between blast furnace and electric arc[24]); (2) it does not reward low-carbon production techniques because, for example, for the same volume of steel product, blast furnace and electric arc production methods would face the same consumption charge; and (3) it does not engage important business advocates for carbon pricing, e.g. in the cement industry, that may be opposed to their particular sector being singled out.

The other more developed options — involving multiple benchmarks or requiring producers, regardless of location, to report life cycle CO_2 emissions (i.e. environmental product declarations) — would be far more effective at inducing upstream decarbonization. If the consumption charge is calculated based on the CO_2 embodied in the product according to its life cycle assessment, producers will be inclined to reduce emissions as much as possible to have a competitive advantage. The CO_2 content of particular products, such as cement or steel, could be calculated according to criteria agreed upon by the International Organization for Standardization (ISO), such as ISO 14025, which is currently under development.[25] This would add to the compliance costs for firms as a requirement for market access, but firms in the relevant export-oriented sectors are arguably capable of fulfilling these functions through third-party verification once the ISO standards are fully developed. The difficulty with this approach is that it may still be too administratively onerous for governments and businesses, and that it is also more challengeable under WTO law as a charge on process and production methods.

The most viable way forward may be a compromise between the simplified and more developed version. Consumption-based carbon pricing could take an evolutionary path: begin with the undifferentiated (or partly differentiated) benchmark approach, but allow any company (domestic or foreign) to, if they wish, provide a fully audited trail proving that their product was produced with lower emissions than the benchmark implies. This would make the process both administratively feasible and politically viable, while also still producing adequate decarbonization incentives. The system can then evolve from there.

POLICY OPTIONS AND REAL-WORLD EXAMPLES

When designing consumption-based carbon pricing, policymakers have several logical possibilities. Most jurisdictions will likely choose to mix different forms of territorial (production-based) and consumption-based carbon pricing rather than sticking to one form exclusively. In practice, the pathway chosen should depend on the particular set of rationales that apply to a given jurisdiction. Table 1 highlights some real-world examples of (and proposals for) CO_2 consumption charges, the sectors to which they have applied, the scope of coverage, and the rationale behind them.

As Table 1 shows, the majority of existing schemes pricing carbon consumption are in the electricity and heating sectors. Thus far, only California and Quebec, and an EU parliamentary proposal for revisions to the EU ETS, have considered expanding coverage to carbon-intensive basic materials — in both cases, coverage was confined to cement. The California and Quebec proposal is still currently under consideration, while the EU ETS proposal failed to pass due largely to concerns that it singled out cement without addressing other relevant commodities. Both of these proposals were prompted by

Table 1: Real-World Policies Pricing Carbon Consumption

Region	Status	Good with price on consumption	Scope of coverage	Policy instrument	Rationale
Tokyo, Japan	Active since 2010	Electricity and fossil fuels	Price on domestic consumption	ETS	Jurisdictional autonomy; principal-agent problem when decarbonizing buildings
South Korea	Active since 2015	Electricity	Price on domestic consumption and production	ETS	To ensure cost pass-through
Australia	Defunct	Synthetic gases	Price on domestic consumption	Tax	To expand gas coverage; also, the diffuse nature of synthetic gas emissions made pricing end-products more practical
California and Quebec	Active since 2012	Electricity	Price on consumption from imports and domestic production	ETS	To cover imports of high-carbon electricity
California and Quebec	Active since 2015	Transportation fuels and natural gas	Price on consumption from imports and domestic production	ETS	To expand coverage
California and Quebec	Proposed	Cement	Price on consumption from imports and domestic production	ETS	To prevent or reduce carbon leakage
China: Beijing, Chongqing, Guangdong, Hubei, Shanghai, Shenzhen, and Tianjin	Active since 2013/2014	Electricity	Price on domestic consumption and imports, and on domestic production	Various absolute, rate-based, and hybrid ETS	To ensure cost pass-through
EU ETS	Proposed	Cement	Price on imports, and on domestic production	ETS	To deal with carbon leakage and level playing field between EU cement and cement imports from countries without a carbon price

Note: Adapted from Table 1 in Munnings et al. (2016).[26]

a desire to expand coverage to commodities while avoiding carbon leakage. California's proposed consumption charge on imported cement would be paid by the first entity receiving the product within California, but different versions of the proposal include both the simplified and differentiated options for the consumption charge, as discussed above. Given the pressing need to ensure decarbonization across emissions-intensive basic materials production while avoiding carbon leakage, it is likely that more jurisdictions will consider and eventually pass analogous laws.

Tokyo stands out as a municipality that has decided to price carbon consumption in electricity and fossil fuels. One motivation for this has been to reclaim jurisdictional autonomy over electricity use, since around 90 percent of the electricity facilities the city is dependent upon are beyond its borders. The other main motivation has been to overcome principal-agent problems in the decarbonization of buildings (i.e. the disparity of incentives between landlords and tenants, as discussed above). By regulating carbon vis-à-vis the owners of building facilities, Tokyo has better aligned incentives for investments in retrofits and other efficiency upgrades than standard production-based policies.

Finally, South Korea and the seven Chinese provinces listed in Table 1 stand out as jurisdictions where the government infrequently sets retail electricity prices, and hence, where carbon production costs are inadequately passed through to retail prices (perhaps even with effectively zero pass-through). In such jurisdictions, consumption-based pricing has been deemed appropriate to ensure that an adequate price signal reaches further downstream in the value chain.

PROSPECTS FOR FURTHER ADOPTION

Pricing carbon consumption has an abundance of compelling rationales, which explains why more governments have been adopting the approach in recent years. It is an emerging trend that may help to close the gap between actual carbon prices and those required to meet the temperature goals of the Paris Agreement.[27] There are numerous technical and administrative details still being debated among civil servants, politicians, industries, and academics — e.g. how to differentiate like-products based on hard-to-verify embodied CO_2 in certain commodities, or whether consumption-based pricing or BCAs are more appropriate in a given political and legal context. The general consensus is, however, that more must be done to improve the efficiency, equity, and effectiveness of carbon pricing. Given the lack of progress on BCAs hitherto amid WTO-related concerns, as well as the risk of delaying action with drawn-out reforms of production-based pricing systems, a more modest but effective complement to existing systems is required. Complementing upstream carbon pricing systems with consumption-based approaches represents one promising trajectory here.

MORE INFORMATION

Context: The Carbon Pricing Leadership Coalition (CPLC) includes governments, businesses and civil society groups working together to identify and address the key challenges to successful use of carbon pricing as a way to combat climate change. This Executive Briefing was made possible thanks to kind support from Climate Strategies. It was authored by Ryan Rafaty (Climate Strategies) under the supervision of Michael Grubb (University College London and Climate Strategies).

References: This Executive Briefing is a synthesis of ideas and literature derived from the key references listed here. Due to limited space, the print version does not include references to specific sources in the text. Such references are included in the digital version available online:

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21 For a review of some of the challenges, see: Grubb, M. and Counsell, T. (2010). Tackling carbon leakage Sector-specific solutions for a world of unequal carbon prices. Carbon Trust, March 2010.

22 More broadly, it is clear that there are already plenty of examples of consumption-based charges that do not evoke legal challenges—e.g. consumption-based taxes on tobacco, gasoline, and other excise charges. However, to be consistent with WTO law and the Agreement on Subsidies and Countervailing Measures, the revenue generated from a consumption-based carbon price could not be earmarked for compensating domestic carbon-intensive producers.

23 Dröge, S., van Asselt, H., Brewer, T., Grubb, M., Ismer, R., Kameyama, Y., Mehling, M., Monjon, S., Neuhoff, K., Quirion, P. and Schumacher, K., 2009. Tackling leakage in a world of unequal carbon prices. *Climate Strategies,* pp. 2–16.

24 In practice, ignoring this difference is unlikely to be politically viable or environmentally effective.

25 https://www.iso.org/standard/38131.html

26 Munnings, C., Acworth, W., Sartor, O., Kim, Y. G., and Neuhoff, K. (2016). Pricing Carbon Consumption: A Review of an Emerging Trend". Resources for the Future, Discussion Paper, November 2016.

27 Stiglitz, J. and Stern, N. Report of the High-Level Commission on Carbon Prices. Carbon Pricing Leadership Coalition. May 29, 2017.