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Price Production and Consumption Separately

Carbon pricing in open economies: an overview of section 1

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ABSTRACT

Carbon prices stay low in open economies because one instrument is asked to do two jobs: to make producers cut emissions per unit of output, and to make buyers pay for the carbon in what they consume. A tax on domestic production charges exporters and spares imports, so governments exempt industry and hold the rate down. The papers in this section give each job its own instrument. A revenue-neutral feebate prices production intensity at the full rate at the margin, at no cost to the treasury. A carbon component of VAT and a forward obligation on fuel suppliers price consumption, imports included. Recognition at the border should credit a trading partner's price signal, measured by country and sector, and the Total Effective Carbon Price puts every instrument on one scale. In hot-rolled steel at $80 per tonne of CO_2, a feebate raises producer prices about a third as much as a tax; payments above half the feebate rate make adoption a gain; and once importers charge by country and sector, each exporter does best with a feebate at the importer's charge.

Overview of section 1, version 0.3, October 2026. Stephen J. Stretton, writing in a personal capacity. The views expressed are the author's own and do not represent those of any institution with which he is or has been affiliated. Each paper below comes as a short policy brief and a full working paper.

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One instrument, two jobs

Carbon prices are too low and too narrow to meet the Paris goals. Explicit carbon prices cover about 28 percent of global emissions, at about $19 per tonne of CO_2 where they apply and about $5 averaged over all emissions (World Bank 2025). The High-Level Commission on Carbon Prices judged that prices of at least $50–100 per tonne by 2030 are consistent with the Paris temperature goals (High-Level Commission on Carbon Prices 2017).

Part of the gap is built into the instrument. A carbon tax on domestic production does two jobs with one rate: it rewards firms for cutting emissions per unit of output, and it charges for the carbon in what the economy consumes. In an open economy it does the second job badly. It falls on exports, which are consumed abroad, and spares imports, which are consumed at home, so governments respond with exemptions, free allocation and low rates (Stretton 2026j).

A border charge on imports fixes only half of the problem. The EU's Carbon Border Adjustment Mechanism (CBAM) protects the home market from untaxed imports (European Parliament and Council 2023). It does nothing for exporters, and, as paper 1.4 shows, the way it measures carbon creates problems of its own.

The papers in this section give each job its own instrument (Table 1). Production, in the trade sense of what a country makes, is priced with a revenue-neutral feebate. Consumption, what a country uses, is priced with a destination-based charge collected through the value-added tax (VAT) and, for fuel, through a forward obligation on suppliers. Border recognition and international payments then need one scale, which the Total Effective Carbon Price supplies.

Job	Instrument	What it prices	Who pays at the margin	Paper
Decarbonize production	Revenue-neutral feebate (or output-based rebating)	Emissions per unit of output above or below a sector benchmark	Every producer, at the full rate; the average producer pays nothing net	1.1, 1.2
Price consumption of goods	Carbon component of VAT, with the value component cut	Carbon embodied in goods consumed at home, imported or domestic	Consumers; exports zero-rated	1.1, 1.3
Price consumption of fuel	Legal obligation on fuel suppliers, fixed a decade ahead	Carbon in fuel burned in homes and vehicles	The few large suppliers of fuel	1.1, 1.3
Recognize policy abroad	Credit for the price signal, measured by country and sector	The price signal a trading partner's policy sends	Exporters with weak policy	1.4
Measure all of it	Total Effective Carbon Price	Any mix of taxes, subsidies, standards and mandates, as one car-	Not an instrument: the scale for crediting and recognition	6.1

Job	Instrument	What it prices	Who pays at the margin	Paper
		bon-tax equiva-lent		

Price production with a feebate (papers 1.1 and 1.2)

A feebate keeps the incentive of a carbon tax and drops the carbon bill. Each producer pays the rate times the gap between its emissions per unit of output and its sector's average: a fee above the average, a rebate below. Fees fund rebates exactly, so the treasury neither gains nor loses, but every tonne avoided is still worth the full rate to the firm (Stretton 2026i). Output-based rebating of a carbon tax is the same instrument.

Its cost to producers is the cost of the abatement, not the bill on remaining emissions. In hot-rolled steel, at $80 per tonne of CO_2 and with intensities set at the EU's default values, a carbon tax raises the producer price by 25 percent for a mill at Türkiye's default intensity and 32 percent at China's; a feebate at the same rate raises it by 8 and 10 percent, about a third as much (paper 1.1). A rate that would be unthinkable as a tax becomes affordable as a feebate.

In power, a feebate runs and builds plants exactly as a tax would, and consumers pay far less. At $50 per tonne in 2024 generation mixes, where a single buyer sets tariffs at average cost, a feebate raises tariffs by $1.3 per megawatt-hour in India, $3.7 in Indonesia and nothing in South Africa, against $33–40 for a tax; in a wholesale market where coal sets the price the rise is $7–18 against $47 (paper 1.2). The equivalence with a tax holds when generators take the benchmark as given or are dispatched on cost plus the full rate (Stretton 2026f).

The benchmark decides whether a feebate works. It must fall as the sector cleans, cover all fuels, and measure a dominant state utility against everyone else's average; otherwise the utility sees only part of the rate (Stretton 2026f). A feebate alone also discourages use of the product less than a tax, so at the same rate it buys fewer tonnes. The consumption track restores that demand response, which is why the architecture, not the feebate alone, is the proposal.

Price consumption through VAT and a forward obligation (paper 1.3)

Europe prices the carbon it emits, not the carbon it consumes. About 40 percent of the carbon in what EU households buy subject to VAT is emitted outside the Union, where neither the Emissions Trading System nor the border mechanism reaches most of it (paper 1.3).

A carbon component inside VAT prices that carbon wherever it is emitted. Every business charges a price per tonne of the carbon embodied in what it sells and deducts what it paid on its inputs, as it already does for VAT; imports pay at the border and exports leave free. One published default per product category, the EU production average, applies to every origin, and any seller can prove a lower figure. The value part of VAT falls each year by last year's carbon receipts, which keeps the swap revenue-neutral (Stretton 2026b).

Fuel for homes and vehicles needs a forward obligation on its few suppliers. Its carbon is released after the last sale, so no charge on goods reaches it. An obligation fixed a decade ahead, with a price floor rising to €200 per tonne in 2037, gives refiners and gas suppliers a price path they can plan on; it would raise about €138 billion a year, or €310 per resident (Stretton 2026b).

The swap is mildly regressive, and returning the obligation's receipts more than fixes that. At €200 per tonne the poorest fifth pays 0.4 percent of spending more, net of the VAT cut, and the richest 0.2 percent less; returning the obligation's receipts as an equal sum

per household leaves the poorest fifth 1.2 percent of spending better off (Stretton 2026a). The obligation can pass by qualified majority as an amendment to the emissions trading directive; the VAT component needs unanimity.

Recognize the price signal at the border (paper 1.4)

Measuring carbon plant by plant pays exporters to route clean steel to Europe, not to make cleaner steel. A producer with both blast furnaces and scrap-fed electric arc furnaces can send its scrap-based steel to the EU and the rest elsewhere. At €80 per tonne of CO_2 that routing is worth €98–626 per tonne of steel across thirteen exporters, with no fall in emissions (Stretton 2026d).

The mechanism credits carbon taxes paid, not the price signal that cuts emissions. It deducts only a carbon price "effectively paid" abroad, net of "any rebate or other form of compensation" (European Parliament and Council of the European Union 2025). A revenue-neutral feebate gives every producer the full price on each tonne it cuts, yet earns nothing, because the average producer pays nothing net (paper 1.4).

Measuring by country and sector ends routing, but on its own leaves each plant almost no incentive. No plant can choose the value the border sees, so routing earns nothing. But a plant with a tenth of its country's output keeps only a tenth of the gain from cutting its own emissions (Stretton 2026d). Crediting the exporting country's price signal restores the incentive on every tonne, and with it a feebate at the EU price pays for itself once more than about a quarter of output is sold to the EU, against half today.

Recognition should be phased in with the end of free allocation to EU producers. Free allocation to the sectors covered by the CBAM falls from 97.5 percent in 2026 to none from 2034 under current law (European Parliament and Council of the European Union 2023); tying recognition to the same schedule keeps EU and foreign producers on a comparable footing, with a review of relocation at each step (Stretton 2026c).

Measure policy by the emissions it cuts (paper 6.1)

Every recognition or crediting rule needs one scale, and the standard metrics do not provide it. The OECD's effective carbon rate and the World Bank's total carbon price add up explicit and indirect prices per tonne, weighted by emissions (Agnolucci et al. 2024). They measure the price signal, not what it achieves: a fuel standard or a revenue-neutral feebate scores zero.

The Total Effective Carbon Price is the uniform carbon tax that would cut emissions by as much as a given policy mix. It builds on the IMF's carbon-price equivalent (Black et al. 2022), with closed-form abatement weights that split any instrument's effect into fuel switching and demand reduction (paper 6.1). In a stylized three-sector economy, a mix that explicit-price metrics rate at $21 per tonne has a Total Effective Carbon Price of $37 in the long run (Stretton 2026h). It is what lets a country that regulates, or uses a feebate, earn the same border credit and the same climate finance as one that taxes.

What the architecture delivers

First, developing-country exporters can price production at rates no tax could reach. The feebate's residual cost is the cost of abatement only and does not depend on trade exposure (Stretton 2026j). Their emissions are in production for export and in new industrial capacity, not in a large consumption base.

Second, climate finance can buy policies rather than projects. If a buyer pays more per tonne than half the feebate rate, adopting the feebate is a net gain to the country, and its best choice is a feebate rate equal to the payment; a World Bank analysis of payments for a donor-supported carbon tax finds the same half-the-rate threshold (Strand 2020). If the buyer counts the reduction under Article 6 of the Paris Agreement, the threshold rises to about one and a half times the rate.

Third, border charges set by country and sector turn leakage into a race to the top. No single mill can move its country's charge, but a national feebate can, so each exporter's lowest delivered cost comes from a feebate at the same rate as the charge in its markets. In a simulated steel market with eight exporters, a charge of $100 per tonne cuts the average carbon content of imports by about 28 percent through the mix of suppliers alone and by about 70 percent when exporters respond (Stretton 2026j). Country-sector measurement, which paper 1.4 proposes to end routing, is the same measurement that creates this incentive.

What to do

Developing-country exporters: start with a production feebate. Begin in power and in the sectors that already report plant emissions to EU importers, steel, cement and aluminum; it needs only sector intensity data and costs the treasury nothing (Stretton 2026i, 2026e).

The EU: credit the price signal, and price consumption. Set border values by exporting country and sector, update them from verified data, and credit feebates and non-price policies at their carbon-price equivalent, phased in with the end of free allocation (Stretton 2026c). Propose the forward obligation on fuel suppliers now, and negotiate a carbon component inside VAT next (Stretton 2026a).

Development banks and climate-finance facilities: pay for policies. Offer a price per tonne for verified cuts in sector intensity, measured as a Total Effective Carbon Price, above half the feebate rate the payment is meant to induce (Stretton 2026g).

The section sets the policy framework that sections 3 and 4 then finance and reward. Section 4's policy crediting pays for tonnes measured on the carbon-price-equivalent scale of paper 6.1.

The papers in this section

No.	Paper	Proposal	Headline number
1.1	Price Production and Consumption Separately	Two tracks: a production feebate and a destination-based consumption charge	Steel at $80/t: a tax raises producer prices 25–32%, a feebate 8–10%
1.2	Feebates: The Full Carbon Price at the	Feebates for coal-heavy power and	At $50/t, regulated tariffs rise $0–4/MWh

No.	Paper	Proposal	Headline number
	Margin, Without the Carbon Bill	trade-exposed industry	under a feebate, $33–40 under a tax
1.3	Converting a VAT into a Destination Carbon Tax	Carbon component of VAT and a forward obligation on fuel suppliers	40% of the carbon in EU households' VAT-taxable purchases is emitted abroad
1.4	Credit the Price Signal, Not the Payment	Measure by country and sector; credit the price signal, phased in with free allocation	Routing clean steel to the EU is worth €98–626/t across thirteen exporters
6.1	Measure Carbon Pricing by the Emissions It Cuts	The Total Effective Carbon Price	A mix rated $21/t on explicit prices has an effective price of $37/t

Two related fiscal papers are outside the series: Rent Tax (paper 2.1, in section 2) and *Stranded by Contract*, on India's legacy coal power purchase agreements (8.1, in Other Writing).

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