Measure Carbon Pricing by the Emissions It Cuts

The Total Effective Carbon Price: one carbon-tax equivalent for any policy mix

Headline carbon prices add up explicit prices, so standards, subsidies and feebates score zero. The Total Effective Carbon Price is the uniform carbon tax that would cut emissions as much as the actual mix: $37 per tonne for a mix that explicit prices rate at $21.

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Explicit prices understate a stylized policy mix by almost half

$21

per tonne of CO_2: the explicit-price measure of a mix of tax, subsidy and fuel standard

$37

per tonne: the same mix measured by the emissions it cuts, in the long run ($32–38 across the evidence)

$28

per tonne after one year, before new capital has replaced old

The mix: a $30/t carbon tax on power and industry, a $10/MWh renewable subsidy and a fuel standard cutting road-fuel carbon intensity by 2%. All numbers are stylized.

Source: Author's calculation, stylized three-sector economy; working paper 6.1, worked example.

Adding up prices measures the signal, not the result

Effective carbon rate (OECD), total carbon price (World Bank): explicit and fuel-tax prices per tonne, weighted by emissions.

Weights by emissions, not response. A $1 tax raises the cost of coal power 1.4% but the price of gasoline 0.2%.

Scores non-price policy at zero: renewable subsidies, fuel standards, procurement rules, and revenue-neutral feebates.

Counting standards at their credit price does not fix it. The comprehensive carbon price rates the mix at $72: a high price on an unresponsive base.

Source: OECD (2023); Agnolucci et al. (2024); Carhart et al. (2022).

The TECP is the uniform carbon tax that would cut emissions as much as the mix

A $30 tax on every fuel is worth $30. Any other instrument is worth the uniform tax that matches its effect, same baseline, same horizon.

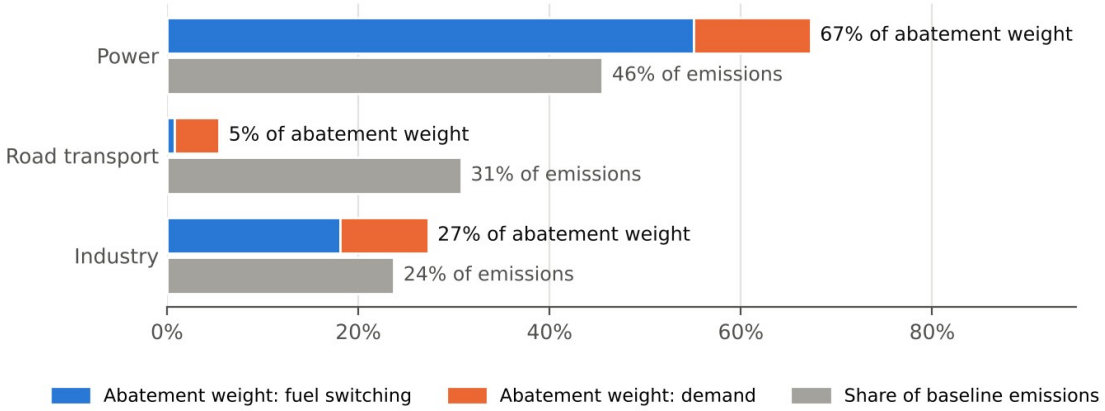
The concept is known; Weil (2021) proposed it, and the IMF computes it with CPAT, one model run per policy.

What is new: a closed form. Weights from an energy balance, fuel prices and two elasticities per sector turn any package into one number.

Two effects: switching to cleaner fuels, and using less energy. A short correction is within 2% of the full model.

Source: Weil (2021); Black et al. (2022); working paper 6.1, Propositions 1–3.

Carbon prices bite in power and industry, barely in road transport



Power: 46% of emissions, 67% of the effect of a uniform tax.

Road transport: 31% of emissions, 5.5% of the effect: fuel is dear per tonne of carbon.

Switching to cleaner fuels carries 74% of the effect, using less energy 26%.

Source: Author's calculation, stylized economy; working paper 6.1, Figure 1.

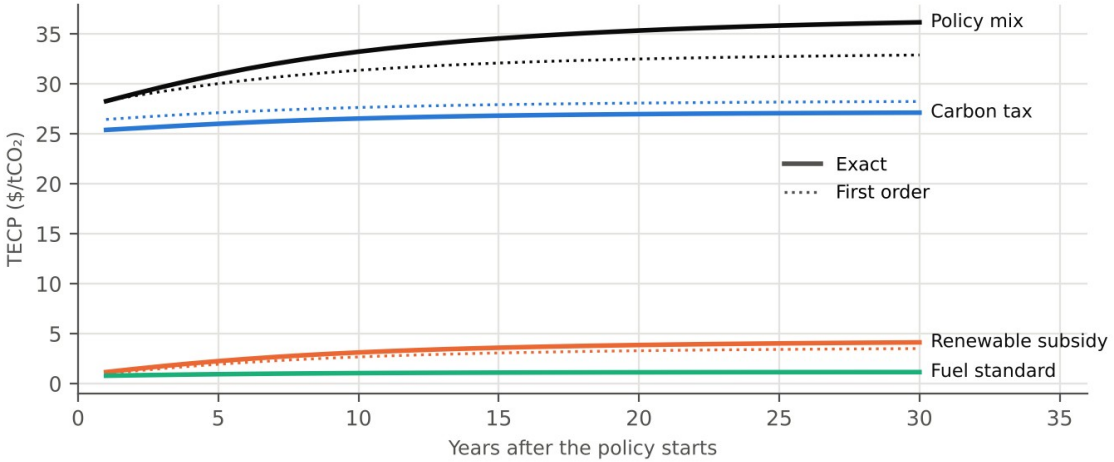
The tax is worth more than its headline; the fuel standard far less than its price

Instrument ($/tCO$_2$)	Explicit	Comprehensive	TECP, long run	TECP, year 1
Carbon tax, $30/t, power + industry	20.8	20.8	27.2	25.4
Renewable subsidy, $10/MWh	0	0	4.3	1.2
Fuel standard, −2% ($166/t credit)	0	51.1	1.2	0.8
Policy mix	20.8	71.8	36.9	28.3

Instruments are scored alone, so they do not add to the mix. The subsidy costs $79 of budget per tonne avoided, yet adds $4: a cost-per-tonne measure would rank it the most ambitious instrument.

Source: Author's calculation, stylized economy; working paper 6.1, worked example; Carhart et al. (2022) for the comprehensive price.

Policies that work by switching fuels take a decade to deliver



Year 1: $28. Year 5: $31. Year 10: $33. Long run: $37.

Switching needs new capital; demand responds in a year or two.

A model that applies long-run responses at once, as CPAT does, would report $37 for year one: 30% too high.

Source: Author's calculation; working paper 6.1, Figure 4; paper 5.4 on CPAT's timing.

Common elasticity errors cancel; errors in demand elasticities alone do not

Calibration	Demand elasticities (power, road, industry)	TECP, long run ($/t)
Central case	0.20, 0.40, 0.30	36.9
Every elasticity at mid-range	0.35, 0.55, 0.50	35.2
CPAT's demand elasticities (paper 5.4)	0.53, 0.58, 0.66	33.1
Demand elasticities halved	0.10, 0.20, 0.15	40.2
Monte Carlo, 90% range	drawn from the evidence	32.4–38.1

The TECP is always above the $21 explicit price. Estimated emission cuts move far more: a third more under CPAT's demand elasticities.

Source: Author's calculation, 2,000 draws; working paper 6.1, calibration; paper 5.4.

Standards and mandates fit on the same scale

Tradable standard: a feebate at its credit price, weighted by how much it cuts.

Non-tradable standard: average marginal compliance cost, weighted by how strongly each firm responds; a simple average overstates it.

Mandate or procurement rule: the uniform tax that matches its measured effect, net of leakage. US state car rules lost 70–80% to leakage.

Inside a binding cap: worth zero; the cap carries the effect.

Source: Working paper 6.1, Propositions 4–5; Goulder, Jacobsen and van Benthem (2012).

Use the TECP to pay for policies, credit them at the border and find weak spots

What the analysis shows

One number: any mix of taxes, subsidies and standards as a uniform carbon tax, in closed form.

Large gap: $37 against $21 explicit; $28 after one year.

Holds across the evidence: $32–38; $33 with CPAT's elasticities.

Limits: measures abatement, not cost; not yet computed for a real country.

Actions

Finance ministries: publish the TECP and its weights beside explicit prices.

World Bank, IMF, OECD: add an effectiveness-weighted series with shared elasticities.

Climate-finance facilities: pay per tonne of change in the TECP, settled on observed emissions.

European Commission: credit the sector's switching-margin TECP under CBAM (Brief 1.4).