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Upgrade the Model Where Policy Needs It

Five modular upgrades to the Climate Policy Assessment Tool: an overview of section 6

Stephen J. Stretton[*]

ABSTRACT

The Climate Policy Assessment Tool (CPAT) tells a finance ministry what a carbon price raises and what it cuts, but ministries keep asking questions its core cannot answer. What is a mix of standards, subsidies and feebates worth as a carbon price? What will the EU carbon border adjustment cost exporters? What will the clean capital cost, and should the budget pay for it? How can CPAT be linked to the other models ministries use? What does a climate program do to growth and debt? This section answers each with one upgrade that reads the rebuilt model's outputs without changing its core: the Total Effective Carbon Price, the CBAM Policy Tool, a public investment extension, a common activity layer, and the Macro-Fiscal-Energy Scenario Tool. Each states its method in a few equations so that a ministry can check it, and each peer review in October 2026 changed a result: the Egypt border charge, the cost of capital CPAT assumes, the island case, the ownership check and Kenya's debt comparison.

Overview of section 6, version 0.2, 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. Companion to the public CPAT-AI repository, https://github.com/cpmodelai/cpat_ai, and the Climate Fiscal AI Tools. Country results quoted here are illustrative tool results, not official estimates. Each paper below comes as a short policy brief and a full working paper.

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A small core and modular upgrades beat one large model

A model a ministry can audit has to stay small, while the questions ministries ask keep growing. Section 5 states CPAT's mitigation module in fourteen equations, rebuilds it twice and checks it against data and other models (Stretton 2026e; CPAT-AI Project 2026). That work pays off only if the core stays legible: every new question answered by adding cells to the core makes the next audit harder.

The papers in this section therefore add capability as separate modules. Each upgrade reads CPAT's outputs (prices, fuel use, power investment, emissions and revenue), adds one piece of economics, and returns a result a ministry can trace back to the core. Each states its method in a few equations, says what it assumes, and labels its country numbers as illustrative. A ministry can adopt one upgrade without the others.

Measure any policy mix as one carbon price (paper 6.1)

Headline carbon prices miss most climate policy (paper 6.1). They add up explicit prices per tonne, so a fuel standard, a clean-power subsidy or a revenue-neutral feebate scores nothing, and a dollar on coal counts the same as a dollar on gasoline. The Total Effective Carbon Price (TECP) is the uniform economy-wide carbon tax that would cut emissions as much as a given policy mix. It builds on the carbon-price equivalent that the International Monetary Fund computes with CPAT (Black et al. 2022), and adds a closed form from an energy balance and two elasticities per sector, a split into fuel switching and using less energy, a treatment of standards and mandates, and a range for elasticity uncertainty (Stretton 2026b).

The difference is large. In a stylized three-sector economy, a mix that explicit prices rate at $21 per tonne is worth $37 in the long run ($32–38 across the evidence on elasticities) and $28 after one year. A model that applies long-run responses in the first year, as CPAT does, would report the $37 at once, about 30 percent too high.

The metric is the common scale for the rest of the program. It lets crediting schemes pay for policies rather than projects, lets border mechanisms recognize non-price carbon pricing, and shows governments where their policy mix is weak; sections 1 and 4 use it for border recognition and policy crediting. Its main limit is stated plainly: it has not yet been computed for a real country.

Measure exposure to the EU carbon border adjustment (paper 6.2)

The EU's carbon border charge is large, and for dirty goods most of it arrives in the first year (paper 6.2). Since January 2026, EU importers of steel, aluminum, cement, fertilizers, hydrogen and electricity have owed certificates for the carbon in what they buy; certificates go on sale in February 2027, and importers of less than 50 tonnes a year are exempt (European Parliament and Council of the European Union 2023, 2025). Turkish hot-rolled steel declared at the EU's default value owes €107 a tonne in 2026 and €252 at full phase-in, close to half its price (Stretton 2026d).

Exporting governments have three levers, and the right one differs by product. Verified emissions data, cleaner production and a domestic carbon price the EU deducts each cut the bill. For Egypt, verified data would cut the charge on steel from €193 million to €16 million a year, but on urea, the largest exposure, only from €369 million to €321 million. In total, Egypt's charge at full phase-in falls from about €793 million a year at default values to €480 million with verified data (2025 trade volumes).

The accounting must follow the EU's rules exactly. The tool's earlier figures (€595 million and €177 million) deducted the carbon bound in urea, which the EU counts as emitted because it is released when urea is spread on fields, and counted only half the ammonia in ammonium nitrate. Correcting both, and using recorded trade volumes, changed the largest line in the results.

Price the clean capital and test whether the budget should pay (paper 6.3)

The cost of capital, not the size of the bill, decides whether clean capital pays its way (paper 6.3). The public investment extension turns the physical change CPAT computes into investment needs by country and sector, and prices that capital three ways: at the market cost of capital, at a 6 percent social rate, and at 6 percent with cleaner air and carbon counted. A stylized clean asset that pays its way handsomely at 6 percent stops paying above 12.6 percent (Stretton 2026c).

Teams using CPAT should say which cost of capital they use. CPAT's default adds a technology premium to each country's own cost of capital, about 2.9 points for wind and solar in a lower-middle-income country; rates by income group (7.5, 10, 12.5 and 15 percent) are an option, and the option puts lower-middle-income countries at 12.5 percent, right on the break-even line (CPAT Team 2024; CPAT-AI Project 2026). Each point off the cost of capital is worth about $36 billion a year for each year's global clean energy investment, which is what the de-risking of section 3 buys.

A project can be worth building and still break the budget's cash flow. A second test asks what each dollar of net public money buys, against the cost of raising a dollar of tax (about 1.2), with cash, debt and contract liabilities on one ledger. In a stylized island, a solar plant worth $108 million leaves the budget $14.6 million a year short on a seven-year loan; a guaranteed power purchase agreement narrows the gap but turns the debt into a contract liability of 7.6 percent of GDP. Illustrative country runs put 2030 investment needs in Kenya, Uganda and St Lucia at 4 to 5 percent of GDP.

Give linked models one activity layer (paper 6.4)

Linked climate models disagree before any policy is applied, because each starts from its own forecast of activity (paper 6.4). CPAT grows fuel use with GDP and prices; SISEPUEDE grows physical activity with income and population but not prices; the CBAM Policy Tool grows industrial output with growth forecasts and a price response; the Future Technology Transformations (FTT) models take demand as given (Syme et al. 2026; Future Technology Transformations developers 2026).

One driver layer fixes this, provided the carbon price reaches demand exactly once. The layer grows ten common activities with population, income per person and the cost of the energy service, from one forecast and one base year, and lets each model keep its own data. It applies its price response only where the receiving model has none (SISEPUEDE and FTT) (Stretton 2026a).

Cars grow faster than travel, so every link needs a check. Under stylized growth of 1 percent a year in population and 2 percent in income per person, cars in use rise 64 percent in ten years and travel 35 percent. Left unchecked, car travel would exceed all travel within about 55 years, even with CPAT's saturating ownership curve; the layer checks every year that it does not. FTT has no car data for 21 of its 71 regions, and SISEPUEDE's country calibrations are not public.

Link energy investment to growth, revenue and debt (paper 6.5)

A climate program changes the budget, the tax base, growth and debt at once, but ministries usually see four unconnected numbers (paper 6.5). The Macro-Fiscal-Energy Scenario Tool puts them in one open workbook for 186 countries: investment needs split by who pays; a screen for the most a carbon tax, a feebate or a mix can cut within political limits; simplified versions of three IMF and World Bank macro-fiscal models; and a debt sustainability test. The simplified models approximate their parents; they are not endorsed by those institutions and have not yet been benchmarked against them (Stretton 2026f).

How a program is financed and how well the money is spent matter more than its size. Earmarked carbon revenue and concessional finance lower the debt path; the efficiency of public investment decides the growth gain. Whether pricing raises revenue depends on which political limit binds: when the loss to coal and oil generators binds, a tax and a feebate cut emissions equally, but only the tax raises money.

For Kenya, the bill is mostly land use and non-CO_2 gases, and carbon pricing pays for little of it. An illustrative run finds a budget need of 0.5 percent of GDP in 2030; feasible power-sector pricing covers about 5 percent of it, because a grid over 90 percent renewable leaves little to tax, and the program adds about 7 points of GDP to debt by 2050. The joint IMF–World Bank analysis already rated Kenya at high risk of debt distress before any program (International Monetary Fund 2024); financing terms, not the program, decide what happens next.

The papers in this section

No.	Paper	What it adds to CPAT	Status
6.1	Measure Carbon Pricing by the Emissions It Cuts: The Total Effective Carbon Price	One carbon-price scale for any policy mix	Working paper v0.4, brief v1.1 and deck (31 October 2026)
6.2	The CBAM Policy Tool	Exporters' border charges, product by product	Working paper v0.2, brief and deck (31 October 2026)
6.3	Public Investment in CPAT: Investment Needs and the Efficiency of Public Spending	Investment needs, the cost of capital and a public-money test	Working paper v0.2, brief and deck (31 October 2026)
6.4	Activity Levels Across CPAT, SISEPUEDE, CBAM and FTT	One driver layer for linked models	Working paper v0.2, brief and deck (31 October 2026)
6.5	The Macro-Fiscal-Energy Scenario Tool	Growth, revenue and debt in one workbook	Working paper v0.2, brief and deck (31 October 2026)

The core these upgrades extend is in section 5, which states the mitigation module, rebuilds it and checks it. The instruments they measure are in section 1, the de-risking that sets the cost of capital is in section 3, and the diagnostics that apply the same standard to data ministries already hold are in section 7.

References

Black, Simon, Danielle Minnett, Ian Parry, James Roaf, and Karlygash Zhunussova. 2022. *A Framework for Comparing Climate Mitigation Policies Across Countries*. IMF Working Paper 22/254. International Monetary Fund. https://doi.org/10.5089/9798400228285.001.

CPAT Team. 2024. *CPAT Documentation*. World Bank; International Monetary Fund. https://cpmodel.github.io/cpat_public/.

CPAT-AI Project. 2026. *CPAT-AI: Excel-AI and CPAT Python, with Documentation, Bug Register and Issue Register*. GitHub repository, Excel-AI release 1.2.1 (31 October 2026). https://github.com/cpmodelai/cpat_ai.

European Parliament and Council of the European Union. 2023. *Regulation (EU) 2023/956 of 10 May 2023 Establishing a Carbon Border Adjustment Mechanism*. Official Journal of the European Union, L 130, 16.5.2023, p. 52. http://data.europa.eu/eli/reg/2023/956/oj.

European Parliament and Council of the European Union. 2025. *Regulation (EU) 2025/2083 of 8 October 2025 Amending Regulation (EU) 2023/956 as Regards Simplifying and Strengthening the Carbon Border Adjustment Mechanism*. Official Journal of the European Union, L series, 2025/2083, 17.10.2025. http://data.europa.eu/eli/reg/2025/2083/oj.

Future Technology Transformations developers. 2026. *FTT_StandAlone: Future Technology Transformation Models in Python*. GitHub repository cpmodel/FTT_StandAlone, commit 896a3ce (28 October 2026). https://github.com/cpmodel/FTT_StandAlone.

International Monetary Fund. 2024. *Kenya: 2023 Article IV Consultation, Sixth Reviews Under the Extended Fund Facility and Extended Credit Facility Arrangements, and First Review Under the Resilience and Sustainability Facility Arrangement*. IMF Country Report 24/13. International Monetary Fund. https://doi.org/10.5089/9798400264177.002.

Stretton, Stephen J. 2026a. "Activity Levels Across CPAT, SISEPUEDE, CBAM and FTT." Unpublished manuscript.

Stretton, Stephen J. 2026b. *Measure Carbon Pricing by the Emissions It Cuts: The Total Effective Carbon Price*. Working paper, version 0.3, October 2026.

Stretton, Stephen J. 2026c. "Public Investment in CPAT: Investment Needs and the Efficiency of Public Spending." Unpublished manuscript.

Stretton, Stephen J. 2026d. "The CBAM Policy Tool." Unpublished manuscript.

Stretton, Stephen J. 2026e. "The CPAT Mitigation Module: Methods in Brief." Unpublished manuscript.

Stretton, Stephen J. 2026f. "The Macro-Fiscal-Energy Scenario Tool." Unpublished manuscript.

Syme, James et al. 2026. *SISEPUEDE: Simulating Sectoral Pathways and Uncertainty Exploration for Decarbonization*. GitHub repository, commit 9bf976c (23 September 2026), with documentation in docs/source. https://github.com/jcsyme/sisepuede.