Sovereign Climate-Contingent Convertible Instrument for Energy Transition Finance in Emerging Markets

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Abstract

This discussion paper examines funding cost reduction in the energy sector for policy-makers and decision-makers. We examine the role of climate-contingent convertible notes (S-CloCos) as a sovereign financing instrument for government-supported power utilities seeking to accelerate renewable-energy development and deployment. This modern financial instrument links the cost of capital to a transparent renewable capital-expenditure index. When renewable capital costs fall sufficiently, a trigger mechanism enables the issuer to restructure financing, accelerate investment, and reduce debt service costs. Using an illustrative cross-country calibration for eleven emerging and middle-income economies, the results suggest model-implied yield reductions ranging from 40 basis points in the United Arab Emirates to 586 basis points in Egypt. Across the sample, the weighted-average yield reduction is approximately 200 basis points, with total illustrative interest savings of USD 125.28 billion. The mechanism is particularly relevant for countries with large fossil-fuel electricity generation fleets, elevated sovereign or quasi-sovereign credit spreads, and a strategic need to attract hard-currency institutional capital.

1 Introduction

Many sovereign governments face a transition-finance constraint. Electricity systems must grow rapidly to support a new age of industrialisation that requires extensive expansion of digital infrastructure, artificial intelligence, electrification, along with climate-policy objectives. Yet the cost of capital remains high, especially in emerging markets, where sovereign debt spreads, currency risk, along with policy uncertainty raise investors' return requirements. Conventional public borrowing may worsen debt sustainability metrics, while standard project finance may be too narrow to support system-wide grid and generation transformation.

In this paper, we initiate the discussion on a new concept and financial instrument, called sovereign climate-contingent convertible note (S-CloCo) that is issued by a state-owned or state-level power utility. The note is denominated in a major currency, typically USD or EUR,

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and references a renewable capital-expenditure index. The policy objective is to reduce the financing cost of the energy transition, attract foreign institutional investment, and to provide a market-based mechanism for accelerating the substitution of fossil-fuel electricity generation with renewable energy and grid assets.

2 Instrument design

An S-CloCo is a bond-like instrument with a contingent transition-finance feature. The issuer pays coupons in the ordinary course of business. The note references a renewable CAPEX index, denoted by C_t, which measures the cost of deploying renewable power capacity and associated infrastructure. A trigger occurs when the index falls below a pre-defined threshold:

$$\tau = \inf\left\{t \geq 0 : \frac{C_t}{C_0} \leq \kappa\right\},$$

where C_0 is the initial index level and $\kappa \in (0, 1)$ is the trigger threshold. For example, $\kappa = 0.8$ would represent a 20 per cent decline in the relevant renewable CAPEX index from the issue date of the bond.

Upon trigger, the issuer may exercise a contractual conversion or call mechanism. In the sovereign-utility setting, this could be implemented through a state-backed capital injection, rights issue, transition fund subscription, or other pre-agreed capital mechanism. Bondholders receive a cash settlement, rather than physical equity exposure, from the proceeds of the capital action. The issuer gains balance-sheet flexibility and may accelerate renewable energy investment as the economics of deployment and innovation improve. In the quasi-sovereign model, governments can engage with the S-CloCo mechanism through listed state-owned firms in which the nation-state is the principal shareholder. The quasi-sovereign mechanism provides a direct private-market funding mechanism and can grant direct ownership of sovereign assets. Such quasi-sovereign companies can utilise domestic pension funds and other institutional investors to draw funding.

The investor, therefore, sells a contingent option to the issuer. In exchange, the investor may receive a yield that is attractive relative to the issuer's improved transition and credit default risk profile, while the issuer benefits from a lower all-in financing cost than with conventional hard-currency debt.

3 Pricing approach

Let y_i^{plain} denote the conventional hard-currency yield for issuer i, and let y_i^{cloco} denote the corresponding S-CloCo yield. The model-implied yield reduction is

$$\Delta y_i = y_i^{plain} - y_i^{cloco}.$$

This reduction can be interpreted as a combination of three effects:

$$\Delta y_i = \underbrace{\Omega_i(C_t, \kappa)}_{\text{value of contingent issuer option}} + \underbrace{\Gamma_i}_{\text{transition-risk reduction}} + \underbrace{\Lambda_i}_{\text{liquidity and policy credibility premium}}.$$

The first component reflects the value of the CAPEX-linked trigger option. The second reflects the possibility that the instrument improves the issuer's long-run credit profile by reducing fossil-fuel exposure and supporting lower-cost power generation. The third reflects market-design benefits: a standardised index, transparent trigger rules, credible legal documentation, and potential participation by multilateral development banks or sovereign wealth funds.

For policy analysis, the financial savings can be approximated by

$$S_i = \frac{\Delta y_i}{10{,}000} K_i,$$

where S_i is the interest saving, Δy_i is expressed in basis points, and K_i is the relevant capital base. In the supplied calibration, the reported savings imply a common scaling assumption that links outstanding fossil-generation capacity to a transition-finance capital base. The estimates should therefore be interpreted as illustrative system-finance magnitudes rather than engineering-level project-cost estimates. A full description of the calculation of the CAPEX-linked trigger on the yield of the S-CloCo can be obtained from [3, 4, 5] and will be available in a forthcoming update of the CloCo paper [5].

4 Illustrative cross-country results

Table 1 reports the supplied calibration. The sample covers countries with different credit ratings, fossil-fuel electricity generation exposures, and estimated CloCo yield reductions. The credit rating and default spread values have been sourced from [2]. The results show three main

Table 1: Illustrative S-CloCo Yield Reductions and Interest Savings

Country	**Rating** (Moody's)	**Adj. Default Spread** (%)	**Country Risk Premium**(%)	**Hazard Rate**	**CloCo Yield Reduction** (bps)
Brazil	Ba1	2.13	3.24	0.0328	199
Egypt	Caa1	6.37	9.71	0.0980	586
India	Baa3	1.87	2.85	0.0288	175
Morocco	Ba1	2.13	3.24	0.0328	199
Philippines	Baa2	1.62	2.46	0.0249	152
Saudi Arabia	Aa3	0.51	0.78	0.0078	48
South Africa	Ba2	2.56	3.90	0.0394	240
Thailand	Baa1	1.36	2.07	0.0209	128
Turkey	Ba3	3.06	4.66	0.0471	286
UAE	Aa2	0.42	0.64	0.0065	40
Vietnam	Ba2	2.56	3.90	0.0394	240

patterns.

- First, the largest absolute saving is estimated for India, at USD 43.75 billion. This reflects the scale effect: even a moderate estimated yield reduction of 175 basis points becomes economically significant when applied to large fossil-fuel electricity generation capacity.
- Second, Egypt has the largest estimated yield reduction, at 586 basis points, and the second-largest total saving, at USD 29.30 billion. This reflects the high credit-spread environment in the supplied calibration. For higher-spread countries, the value of a credible transition-linked financing instrument may be greatest if it reduces refinancing risk, foreign-exchange funding constraints, and investor uncertainty.
- Third, high-rated issuers such as Saudi Arabia and the United Arab Emirates show smaller basis-point reductions, at 48 and 40 basis points respectively. However, these countries may still benefit strategically from S-CloCos because the instrument can deepen hard-currency climate-finance markets, create benchmark curves, and support outward investment into renewable supply chains.

Country	Outstanding Generation (GW)	Interest Saving (USD bn)
Brazil	30	5.97
Egypt	50	29.30
India	250	43.75
Morocco	6	1.19
Philippines	21	3.19
Saudi Arabia	60	2.88
South Africa	43	10.32
Thailand	40	5.12
Turkey (updated February 2026)	46	13.16
United Arab Emirates	44	1.76
Vietnam	36	8.64
Total	**626**	**125.28**

Table 2: Outstanding fossil-fuel electricity generation and estimated interest savings if all outstanding generation capacity uses S-CloCo funding. Source [1].

5 Policy rationale and macroeconomic impact

For finance ministries, the main attraction of S-CloCos is that they convert part of the energy-transition problem from a fiscal-transfer problem into a market-design solution. Instead of relying exclusively on direct public borrowing, the sovereign entity can help create a structured asset class in which institutional investors fund state-level utilities under clear, index-linked transition rules.

The instrument can serve six policy functions:

- **Building the public private energy companies to drive investment**

  Leveraging the ability to engage sovereign entities to provide power is important; however, to encourage private-sector ownership and engagement, sovereign nations should seek to convert the public energy company to a public-private firm over time to part-private ownership through the equity market. Furthermore, engaging international markets is important for capital raising and investor confidence. The S-CloCo issuance provides private investors returns, and the rights issue conversion mechanism provides a means for private/institutional investors to acquire private ownership of the public-private energy firm.

- **Reducing the weighted average cost of capital**

  A lower power-sector cost of capital reduces the levelised cost of electricity. This can support industrial competitiveness, reduce inflationary pressure from energy costs, and improve the investment case for electricity-intensive sectors such as data centres, green hydrogen, advanced manufacturing, and AI infrastructure.

- **Attracting hard-currency capital**

  Hard-currency issuance can widen the investor base to global fixed-income investors, insurers, pension funds, sovereign wealth funds, and climate-finance mandates. For emerging markets, this may be particularly valuable where domestic capital markets are insufficiently deep to fund large-scale electricity-system transformation.

- **Creating a renewable CAPEX benchmark**

  The CAPEX index is central to the market design. A credible index can improve price discovery for renewable deployment costs, supserve as a common reference point for

sovereigns, utilities, investors, and development finances, and development-finance institutions. Over time, the index could become a public-good infrastructure for transition finance.

- **Improving fiscal and quasi-fiscal resilience**

  Where state-owned utilities are financially weak, power-sector investment often migrates onto the sovereign balance sheet through guarantees, subsidies, or emergency recapitalisations. S-CloCos may reduce this contingent fiscal burden by lowering financing costs ex ante and aligning investment acceleration with periods when renewable CAPEX has become more favourable.

- **Systemic driver of GDP growth**

  The ability to reduce funding costs across a whole economy through the issuance of the S-CloCo to systemically drive down the price of energy and increase the rate of deployment of lower-cost renewables. This opportunity for growth can act as a stabiliser and wider growth opportunity for the local currency proving a further opportunity for wider economic investment.

6 Risks and safeguards

S-CloCos should not be viewed as a substitute for sound fiscal management, tariff reform, or credible power-market regulation. Several safeguards are necessary.

- First, the CAPEX index must be independently governed. It should use transparent methodology, multiple data providers, audit rights, anti-manipulation procedures, and clear fallback rules. Preliminary work has started on its design, costing, governance and maintenance. This is an area that policymakers should seek to actively promote and develop internationally.

- Second, the hard-currency nature of the instrument creates foreign-exchange risk. This risk should be mitigated through natural hard-currency revenues, hedging, reserve accounts, multilateral liquidity facilities, or tariff frameworks that do not destabilise households and firms.

- Third, the conversion or cash-settlement mechanism must be legally robust. Investors must know whether the trigger creates an issuer option, a mandatory redemption, a capital injection, or a rights-based refinancing event.

- Fourth, public-sector contingent liabilities must be disclosed. If the sovereign provides guarantees, liquidity support, or capital commitments, these should be recorded within the fiscal-risk framework.

- Fifth, proceeds should be ring-fenced for eligible transition assets. Without credible use-of-proceeds rules, the instrument may be priced as ordinary quasi-sovereign debt rather than as transition-enhancing capital.

7 Implications for finance ministries

The discussion suggests that finance ministries could use S-CloCos as part of a broader sovereign transition-finance strategy. The most immediate application is not necessarily direct sovereign issuance, but issuance by state-owned utilities, grid companies, or national energy-transition vehicles with defined sovereign support.

A practical programme would involve:

$$\begin{array}{c} \text{Index governance} \\ \downarrow \\ \text{Public-private energy firm and/or support for current Private Firm} \\ \downarrow \\ \text{Pilot issuance} \\ \downarrow \\ \text{Benchmark curve formation} \\ \downarrow \\ \text{MDB participation} \\ \downarrow \\ \text{Scaling across utilities and grids} \\ \downarrow \\ \text{Anticipation of future economic growth} \end{array} . \quad (1)$$

Countries with higher spreads may obtain larger basis-point reductions, while countries with larger fossil-generation fleets may obtain larger absolute savings. The supplied calibration therefore identifies India, Egypt, Turkey, South Africa, and Vietnam as especially relevant cases for further feasibility analysis. Brazil and Morocco may also benefit from index-market formation, while Saudi Arabia and the United Arab Emirates could play an important role as anchor issuers or investors in the development of the asset class.

Taking each of these steps in turn the impications and the impact of each step is outlined below:

- **Index governance**

  The design and development of the CAPEX index can be achieved at a large scale, benefiting a variety of nations with either, developed or emerging markets. The index is driven by provided quotes and actual transactions of the relevant capital items in each renewable technology from global manufacturers. For example, for wind, generation is provided by a relatively small number of global firms across the US, Europe and China. The CAPEX index could be based on 45% turbine supply, 20% towers/blades/nacelle logistics, with the remaining costs dependent on local factors such as 15% civil engineering/foundations, 10% grid connection proxy, 10% service/warranty package. The terms of each CAPEX index and its impact on total cost should be defined, for example, via a multiplier on the core CAPEX items (in this case, turbines, towers, blades, nacelle). The case for solar is simpler, where costs are typically decomposed into 40% modules, 15% inverters, 10% trackers/mounting, 15% eBOS/electrical, 20% EPC/construction adjustment. Many solar providers provide complete hardware packages with the local developer left to install the panels.

- **Setting up public-private energy firm**

  Define the legal entity to be funded via the S-CloCo mechanism; this can be a new public energy company or an existing energy company for which the government provides price support.

- **Benchmark CAPEX index curve**

  The establishment of the CAPEX index (spot price) would encourage a longer-dated forward curve to reflect future delivery. This curve, if actively traded as a cash market, can help provide further hedging to reduce project delivery risks.

- **Pilot issuance**

  With the CAPEX index created, moving to a first pilot issuance is critical to establish the impact on the market. The implications for lower funding costs and the ability for nations to adjust power prices, once the conversion of the S-CloCo is triggered, sends an important signal to other project providers. This produces an impact across the market and drives more competitive pricing.

- **Multi-lateral development bank (MDB) participation**

  The engagement of MDB to hold and act as book runners for the bonds may help to de-risk by acting as an underwriter to the rights issue. The correct structuring of the trigger enables the CloCo to provide an enhanced opportunity for growth through reduced funding costs, productivity gains, and GDP growth that arises from lower energy costs.

- **Scale up**

  The impact of reduced funding costs is expected to further scale up lower-cost renewables and drive wider sectoral GDP growth as lower energy costs feed into the wider economy.

8 Conclusion

Sovereign CloCos offer a powerful instrument for aligning public finance, electricity-market reform, and climate-transition investment. By linking debt-service economics to a renewable CAPEX index, the instrument can reduce financing costs when transition economics improve, attract hard-currency institutional capital, and provide a disciplined framework for accelerating power-sector investment.

The illustrative results are economically material. Across the supplied sample, the weighted-average yield reduction is approximately 200 basis points, with model-implied savings of USD 125.28 billion. The largest estimated savings arise where either the fossil-fuel electricity generation base is large, as in India, or credit spreads are elevated, as in Egypt and Turkey.

For policymakers, the central message is that the value of S-CloCos depends not only on the option embedded in the bond, but also on institutional credibility. A successful market requires a trusted CAPEX index, clear legal documentation, transparent fiscal-risk treatment, prudent foreign-exchange management, and credible use-of-proceeds governance. If these conditions are met, S-CloCos could serve as a useful bridge between sovereign development strategies and global institutional capital that seeks scalable transition finance opportunities.

References

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