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Long-Term Contracts for Electricity and Carbon Trading: Which Policy mix to Support Decarbonized Investment ?

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Extended Abstract

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Abstract Summary

Decarbonizing electricity systems requires massive low-carbon investment. Carbon pricing through the Emission Trading System (ETS) constitutes the primary policy instrument, transmitting abatement incentives via the merit order. However, electricity markets remain structurally incomplete: missing long-term hedging instruments, limited risk-bearing capacity, and entry-exit coordination failures weaken the investment signal that the carbon price alone is meant to provide. These imperfections push regulators toward hybrid market architectures—combining competition for the market through centrally procured long-term contracts (LTCs) with competition in the market through short-term dispatch—yet the structural coupling between these instruments remains poorly understood. We develop a hybrid optimization-simulation framework that jointly endogenizes carbon prices, electricity prices, LTC strike prices, and investment decisions under market frictions (risk aversion, myopia, investment lumpiness, and coordination failures) a combination absent from existing power system models. The framework extends Lebeau et al. (2024) by embedding a carbon-price convergence loop within the simulation module and deriving competitive strike prices from a generation-expansion planning model that internalizes contracted capacities. Applied to a stylized Spanish system over a 25-year horizon, the framework yields four results. First, an endogenous carbon price can restore optimal low-carbon deployment under risk aversion by absorbing the risk premium into higher permit prices. Second, when the carbon market itself faces frictions (myopia and price bounds) the carbon price undershoots early and overreacts late, failing to deliver timely signals and leaving a non-trivial economic space that justifies the regulatory shift toward hybrid markets. Third, once LTCs are introduced, their presence suppresses carbon prices, which erodes post-contract merchant revenues and raises the competitive strike, amplifying fiscal exposure—a double cost invisible without joint endogenous pricing. Fourth, these trade-

offs define a frontier along which the cost-effective balance between ETS reliance and LTC coverage varies systematically with the prevailing degree of myopia and risk aversion.

Presenting Author Biography

Matthieu Delacommune earned an engineering degree from CentraleSupélec, Université Paris-Saclay, with a specialization in power energy grids. He then completed a Master's in Energy Economics at the IFP School and the INSTN. Currently, he is pursuing a PhD at LGI CentraleSupélec and EDF Research & Development, concentrating on long-term market-design architecture.