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A Win–Win Mechanism for Electricity Procurement by a Local Distribution Company

A time-of-use rate option design allowing an LDC's customers to allocate their consumption to be billed at the fixed and daily-varying TOU rates offers a win–win mechanism for electricity procurement in the face of uncertain spot prices and hedging options. Even if all customers have the same risk preferences, the proposed mechanism is Pareto-superior to the tariffs and procurement strategies commonly used in North America.

C.K. Woo, Ira Horowitz, Gabe Kwok, Shui-Ki Wan and Weiwei Weng

I. Introduction

Electricity market reform and deregulation have resulted in wholesale spot markets in Europe, Australia, New Zealand, and parts of North and South America.¹ Spot electricity prices are inherently volatile with sharp spikes, thanks to daily fuel-cost variations, especially for the natural gas now widely used by the popular combined-cycle gas

turbines; weather-dependent and time-varying demands that must be met in real time by generation and transmission already in place; unpredictable and random output from renewable resources (e.g., solar and wind); changes in available capacity caused by planned and forced outages of electrical facilities; price manipulation during generation shortages; precipitation and river flow for a system with significant

hydro resources; carbon-price variations that affect thermal generation using fossil fuels; transmission constraints that cause transmission congestion and generation redispatch; and lumpy capacity additions that can only occur with long lead times.²

A regulated local distribution company (LDC) procures electricity from the wholesale market for resale to meet the demands of its retail customers.³ From a supply perspective, the LDC can mitigate its procurement cost risk by buying forward contracts, tolling agreements, and capacity options.⁴ From a demand perspective,⁵ the LDC can (1) offer reliability-differentiated tariffs that allow it to curtail sales when wholesale spot-market prices are high,⁶ and (2) implement real-time pricing that passes on the wholesale spot prices to its retail customers.⁷

To manage its portfolio of supply resources and retail sales, LDC management considers the tradeoffs between the procurement cost expectation and its variance.⁸ The optimal portfolio choice that drives the LDC's procurement plan, however, requires an assumption as to management's risk preferences,⁹ which may be open to debate and challenge.

Even though the LDC may have been diligent in its procurement and risk management, it can still face the asymmetric risk of *ex post* prudence review by a

regulator.¹⁰ Under cost-of-service regulation, the LDC can at best recover its procurement spending.¹¹ If the LDC's hedging results in a large *ex post* loss, the regulator may disallow its recovery, thus harming the LDC's earnings. To minimize the risk of *ex post* cost disallowance, LDC management may decide not to hedge. Such a strategy, however, can backfire.

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In a rapid price escalation environment, a regulatory lag may cause the spot-market purchase cost paid by the LDC to far exceed the bill payments made by its customers, translating into a large loan from the LDC to those customers. If disallowed by the regulator, the unpaid loan can bankrupt the LDC.¹² In response to the spot-price volatility and spikes, the regulator (e.g., the California Public Utilities Commission) may require forward contracting by the LDC for the bulk (i.e., 95 percent) of its retail sales.¹³ While the regulatory requirement may be justified by the presumption of customer

preferences for known and stable rates, it is economically inefficient if some customers do not desire fixed prices for the bulk of their consumption.

This article presents an electricity procurement mechanism developed by a California-based contract-research firm that focuses on energy-related issues, for its local distribution company (LDC) clients. The mechanism integrates and extends studies done for LDCs in California, the Pacific Northwest, Florida, Missouri, British Columbia, and Israel in connection to electricity-rate options, electricity portfolio management, and procurement-cost recovery. It shows that even if an LDC's customers have identical risk preferences, the LDC can implement a win-win mechanism for electricity procurement in the face of uncertain spot prices and hedging options. Enabled by smart meters that record hourly consumption by each customer as part of the smart electricity grid initiative,¹⁴ the mechanism integrates Pareto-superior time-of-use (TOU) rate options¹⁵ into electricity portfolio management.¹⁶ Since the mechanism induces the customers to reveal their preferences for fixed vs. daily-varying TOU rates, it helps determine the LDC's customer-driven procurement plan. Since the LDC's procurement plan is driven by customers' self-revealed preferences, it preempts the need and reason for *ex post* prudence review by a regulator.

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