
Electricity Price Formation Challenges in a Grid in Transition- What is this about?

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Price formation in Europe and the U.S.

- Europe: power consumption and supply are balanced in real-time in pay-as-bid balancing mechanisms, with no transparent spot price, and typically with an objective function that does not minimize cost nor maximize social welfare.
- In the U.S., and soon in Ontario, power consumption and supply are balanced in a real-time spot market based on market participant offer prices, security constrained economic dispatch with transparent locational spot prices (LMP pricing) and a welfare maximizing objective function.

Why do North American system operators care about price formation?

In real-time operations, a spot price consistent with market conditions:

- Guides efficient market participant scheduling of price taking import and export schedules between market regions (interchange)
- Enables efficient market participation of price responsive, but off dispatch, power consumers (including: a) networks that may include a power consumer, intermittent resource output and a storage resource; b) price responsive electric vehicle charging controlled by a retailer or utility).
- Enables storage resource operators to use offer prices to guide efficient intra-day use of storage resources, while managing state-of-charge.
- Can be used to set imbalance prices that provide efficient performance incentives for resources with forward schedules (day-ahead market).
- Guides efficient resource operator scheduling of cascade hydro systems.

What is the context?

While price formation is an ISO function, ISOs do not determine price formation rules in a vacuum. Changes to ISO price formation rules are determined in a regulated process that is FERC jurisdictional, but with many stakeholders.

Moreover, price formation not only embraces the price of electricity/energy, but also the prices of ancillary services such as regulation, reserves, ramping products and sometimes other products. Many North American ISOs co-optimize procurement of these ancillary services with the production and pricing of energy.

What is the issue?

While the basic methodology for determining prices on a transmission grid is well established in the U.S. (LMP pricing), there are some factors that should affect locational prices on an interconnected transmission grid that are not necessarily accounted for in the normal operation of LMP markets based on security constrained economic dispatch and market participant offer prices. These other factors tend to be most significant during stressed system conditions.

- How are prices set when net load is met at the margin by activating resources that are either on or off (i. e. not dispatchable) – some types of quick starting thermal units, many types of demand response resources.
- How are prices set when transmission limits are violated in the dispatch solution, potentially adversely impacting transmission system reliability?

What is the issue?

- How are prices set when load is prepared for automatic shedding in the event of a generator or transmission contingency (outage) in order to meet reserve requirements?
- How are prices set as reserves fall below the reliability target with potentially adverse impacts on transmission system reliability, and when they further decline towards the point at which involuntary load shedding (rolling blackouts) would be initiated?
- How are prices set when other reliability constraints are violated or operators take other emergency actions?
- What price or offer price floors should be put in place when regulators and/or legislators create per megawatt output subsidies that incent suppliers receiving these subsidies to offer their supply materially below social cost.