Enhancing intraday price signals in U.S. ISO markets for a better integration of variable energy resources

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Executive summary

A sequence of wholesale electricity markets –from years-ahead long-term markets, to the very short-term balancing and regulation markets– dictate the operation of modern power systems. Day-ahead markets (DAM) have been a key link in this chain of decisions; the DAM concentrates most electricity trading because one day in advance is a suitable timeframe to both forecast demand consumption, and to schedule thermal plant commitments. However, as Variable Energy Resources (VER) achieve relevant shares in the electricity mix, the growing uncertainty after DAM production schedules are cleared is increasing the need to refine the design of shorter-term markets. Efficient operation of power systems now requires flexible resources and markets, capable of adapting to changing conditions in the intraday horizon. It is of utmost importance to reflect these needs in price signals, to align the incentives of market agents with the new challenges.

In the European context, intraday markets have proven to be critical in accommodating large amounts of solar and wind production. Intraday markets mitigate rescheduling cost in two ways. First, intraday markets that cover a wide range of timescales allow VER to gradually correct their programs, thus reducing the impact of their forecast errors on the overall cost of the system. Second, intraday markets produce intraday price signals that reflect the cost of making these corrections at different points in time. Intraday prices serve to efficiently allocate rescheduling costs to the units responsible for such adjustments, thus creating a significant incentive for renewable generators to improve their prediction procedures and to rectify forecast errors as soon as possible.

This paper attempts to transfer lessons learned about VER integration in the European context to the U.S., and proposes an alternative settlement system to improve intraday price signals in U.S. electricity markets. U.S. markets were designed around the "two-settlement" concept, which settles all deviations from the day-ahead program at the real-time price, regardless of when (how in advance) and at which specific cost the deviation was corrected. The two-settlement system

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Executive summary of the article: Author1, Author2 and Author3, 2016. The Energy Journal, Vol. XX XX. http://dx.doi.org/XXXXXXXX

does not produce intraday price signals, so it lacks the positive characteristics of intraday markets.

ISO markets include intraday commitment processes that allow for gradual forecast corrections. However, in most power systems, VER cannot provide updated intraday forecast information to the ISO. Furthermore, intraday commitment processes do not produce financially binding schedules and prices, so there are no incentives to engage market agents in the intraday horizon.

This paper shows how U.S. ISOs can maintain an efficient centralized dispatch approach and still provide more cost reflective intraday price signals. We propose a move from the two-settlement system to a "multi-settlement" system. The philosophy of the multi-settlement system is for each intraday commitment process to be followed by its corresponding pricing and settlement procedure, based on the marginal cost of the dispatch problem, as it is done in the day ahead forward market. Because the additional settlements can be performed from the results of existing intraday commitment processes, the multi-settlement system does not entail an additional computational burden. Agents are encouraged to continuously submit their most updated production forecasts, which are used by the ISO to update commitment and dispatch instructions at a cost that can be allocated to forecast deviations charging the marginal cost of the required dispatch correction. This incentivizes producers to submit the most accurate forecast possible when each intraday commitment is performed.

The multi-settlement system is further described in the paper, along with a discussion of its practical implementation, and a case study to illustrate its benefits in terms of the enhanced economic incentives with respect to the two-settlement system. The case study shows that the two-settlement system over-penalizes producers capable of providing accurate and timely forecast updates, and under-penalizes the units which cause greater rescheduling costs. The proposed multi-settlement system, allows to allocate intraday costs according to cost causality principles, improves price formation, and creates efficient signals for market agents to improve forecast accuracy.

Keywords Electricity market design, Renewable integration, Intraday, Price formation, Uplift.

Executive summary of the article: Author1, Author2 and Author3, 2016. The Energy Journal, Vol. XX XX. http://dx.doi.org/XXXXXXXX