Joint and Common Market

COORDINATED TRANSACTION SCHEDULING (CTS) POST-IMPLEMENTATION ANALYSIS

Overview

- Coordinated Transaction Scheduling (CTS) provides a mechanism to better align RTO interchange with economics
  - It allows Market Participants the opportunity to submit financial bids for real time interchange transactions between MISO and PJM
  - This is an additional, optional mechanism over the existing scheduling process
  - CTS is designed to…
    - Enhance Net Scheduled Interchange predictability
    - Enhance MISO-PJM price convergence
    - Lower production cost in both markets
- CTS was implemented October 3, 2017 after a multi-year design and implementation effort between MISO and PJM
- Since then Real-Time spreads have come down and traders gained the ability to submit physical schedules until 20 minutes before each interval

Estimated CTS benefits based on price differentials

Summer	2011	2012	2013	2014	2015	2016	2017	2018
Average Divergence	$ 13.62	$ 11.37	$ 9.46	$ 7.30	$ 6.50	$ 7.15	$ 5.31	$ 6.18
Std. Dev.	$ 26.35	$ 32.99	$ 17.58	$ 13.84	$ 13.94	$ 15.20	$ 10.89	$ 12.04

- CTS design began in earnest in 2011
- Benefits were estimated based on a year's worth of hourly LMPs and supply curve data
  - When LMP spread > $5, dispatch one RTO up and the other down in 50MW steps up to 500
  - Calculate production cost savings for year
  - Repeat for $10 and $15 spread requirements and flow up to 1,000 MWs

CTS Bids, Cleared Volumes and Directions

Month	Unique Bidders	CTS Bids MWh (Total)	Cleared CTS MWh (Total)	PJM->MISO MWh	MISO->PJM MWh	% of Bid MW Volume Cleared
Oct-2017	11	27,131	5,448	1,974	3,474	20
Nov-2017	4	58,342	13,464	1,283	12,181	23
Dec-2017	6	22,444	3,320	3,108	212	15
Jan-2018	4	923	103	78	25	11
Feb-2018	3	7,150	1,376	1,376	0	19
Mar-2018	1	375	139	0	139	37
Apr-2018	2	12,200	500	500	0	4
May-2018	0	0	0	0	0	N/A
Jun-2018	1	1,025	388	388	0	38
Jul-2018	0	0	0	0	0	N/A
Aug-2018	1	250	0	0	0	0
Sep-2018	1	675	375	375	0	56
Oct-2018	3	1525	120	120	0	8

Forecast vs. Actual LMP Data

MISO

Month	Forecast	Actual	Error
Oct-17	$27.11	$26.55	$0.57
Nov-17	$28.09	$26.24	$1.85
Dec-17	$27.08	$25.54	$1.55
Jan-18	$38.72	$35.07	$3.65
Feb-18	$25.32	$24.35	$0.97
Mar-18	$25.29	$22.58	$2.71
Apr-18	$32.38	$29.31	$3.07
May-18	$30.52	$28.58	$1.94
Jun-18	$22.54	$26.66	($4.11)
Jul-18	$22.18	$29.23	($7.05)
Aug-18	$22.78	$30.81	($8.03)
Sep-18	$23.59	$31.61	($8.02)
Oct-18	$23.84	$30.21	($6.37)

PJM

Forecast	Actual	Error
$26.41	$26.17	$0.24
$26.32	$26.04	$0.28
$24.37	$27.95	($3.58)
$30.41	$38.88	($8.47)
$22.13	$23.84	($1.71)
$23.34	$24.51	($1.17)
$29.51	$29.58	($0.07)
$27.15	$30.27	($3.12)
$24.45	$25.70	($1.25)
$25.36	$28.30	($2.94)
$29.20	$29.74	($0.54)
$30.40	$30.31	$0.09
$26.41	$26.17	$0.24

Key Takeaways – MISO's Position

- CTS activity peaked a year ago at an average of ~5 MW per 15-minute interval and has since trailed off
- Significant design and implementation changes would be needed to materially improve incentives for CTS activity
  - Reduce or eliminate transmission reservation fees as suggested by IMM
  - Eliminate allocation of MISO schedule 26-A and PJM uplift
  - Improve forecast accuracy by projecting the spread directly instead of interface LMPs

MISO Position - Fees reduce traders' incentives to offer CTS

- CTS traders are looking to arbitrage real-time price differences at the seam
  - Allocating fees to CTS can hurt the economic efficiency of the product, hampering its ability to optimize interchange based on prices
  - Fees incurred when not clearing CTS impact the revenues traders need to recoup when they do clear leading to higher offers
- Market Participants have to pay for drive-out transmission service in order to submit CTS bids and offers
  - MISO charges ~$0.90/MWh for reservations to the PJM seam
  - PJM charges ~$0.83/MWh for reservations to the MISO seam
  - Both RTOs offer essentially free spot-in transmission service
- MISO allocates cleared CTS exports ~$1.70 per MWh for MVP* fees
- PJM allocates uplift charges to CTS
- In addition to the issues above, MISO is now seeing significant issues with the accuracy of its forecasts

*Multi-Value Projects, aka schedule 26-A

MISO Report on Forecast Accuracy

- As of last February MISO was over-forecasting PJMC by ~5% on average
  - This would tend to clear more CTS imports to MISO than is economic

- Beginning in June MISO's CTS Engine has produced significantly lower forecasts that average ~30% below actual PJMC
  - It is unclear what changed but we are exploring the issue
  - This under-forecasting reduces the likelihood of clearing CTS imports
  - Traders could counteract forecast inaccuracy with negative bids (CTS activity done at their own risk)

Key Takeaways - PJM Position

- PJM recognizes that there has been less activity involving CTS transactions over recent past history.
- PJM believes the combinations of the efficient M2M coordination process and system conditions (lower congestion/fuel prices) has reduced the opportunities for participants to engage in CTS
  - PJM does not think this is a problem and it reflects the success of the M2M coordination process
  - Opportunities for CTS are naturally limited when system conditions reflect lower congestion and prices
  - CTS is still an added value product that can be utilized when opportunities exist

Contacts

- Dustin Grethen dgrethen@misoenergy.org
- Anupam Thatte athatte@misoenergy.org
- Tim Horger Tim.Horger@pjm.com
- Michael Olaleye Michael.Olaleye@pjm.com