PJM/MISO Coordinated Transaction Scheduling

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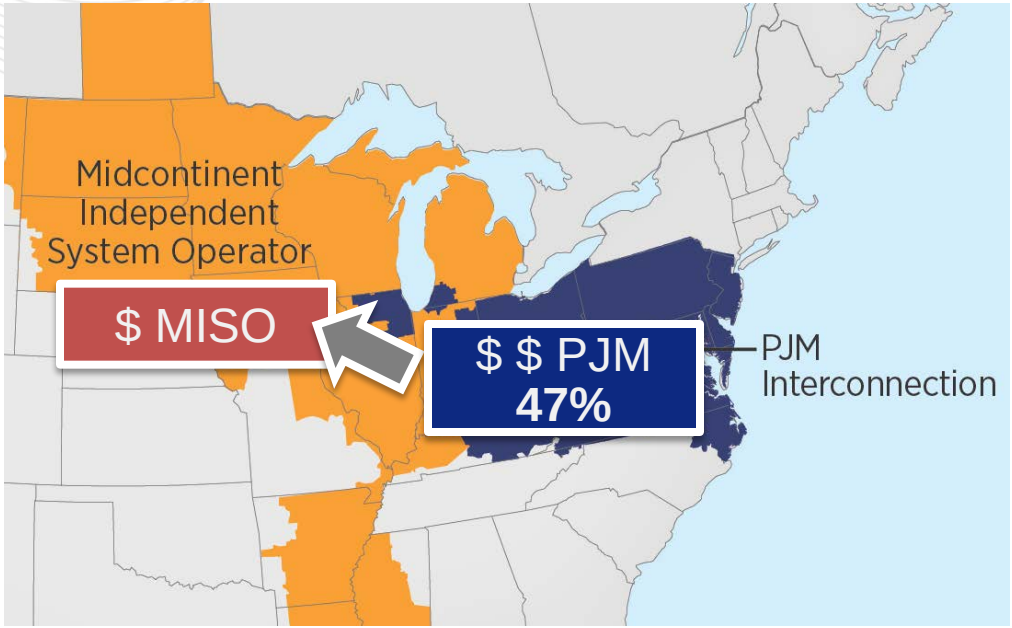
January 8, 2015

MISO-PJM Interchange Optimization

The objective of Coordinated Transaction Scheduling (CTS) is to improve interchange scheduling efficiency

- Increase alignment of energy scheduling with interface prices
- Adds the option for Market Participants to schedule energy transactions across the MISO/PJM interface using an interface bid



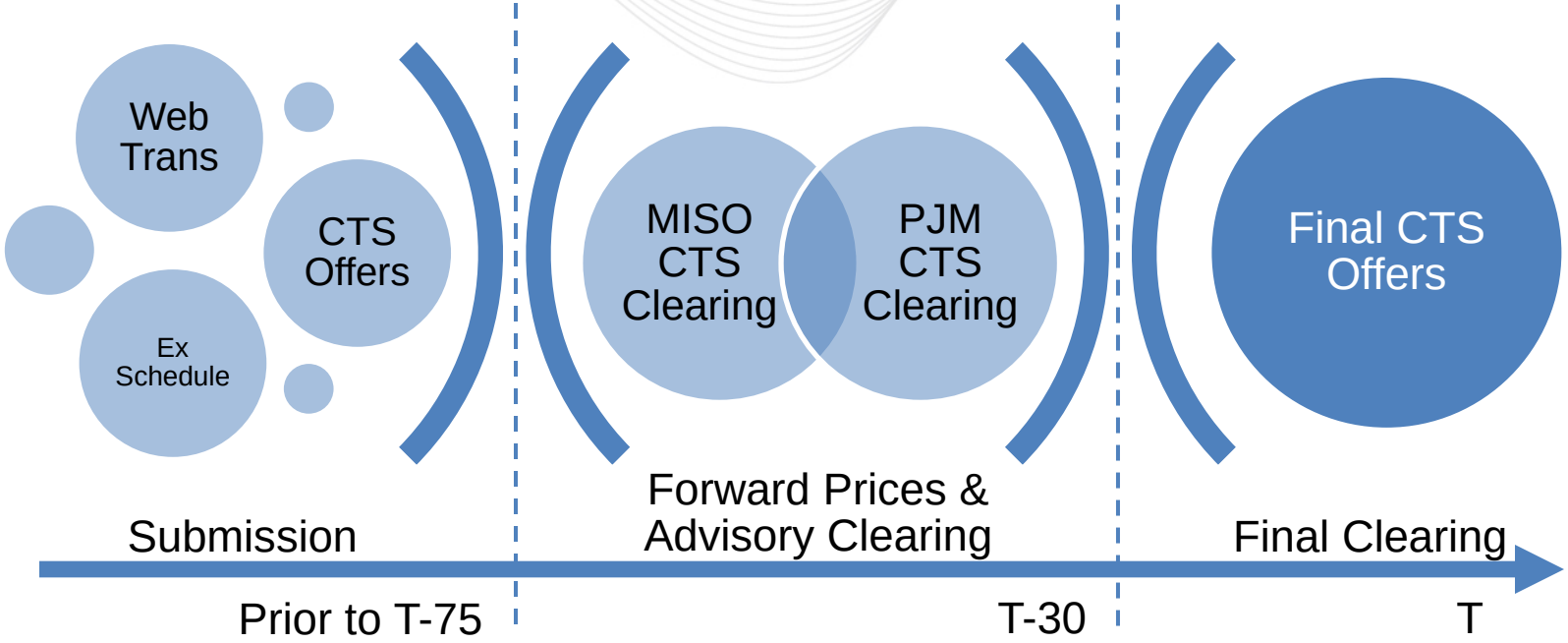
Stakeholder Education

- PJM and MISO have held multiple joint stakeholder meetings to explore the possibility of developing an additional scheduling product
  - Topics included
    - A summary of the background, current issues, objectives and a high level conceptual solution approach for Coordinated Transaction Scheduling (CTS)
    - Characteristics of CTS
    - Market Settlement Impacts
    - MISO Extended LMP Impacts
    - Cost Benefit analysis
  - Meeting materials can be found utilizing the links below
    - April 18, 2014
    - June 10, 2014
    - November 11, 2014

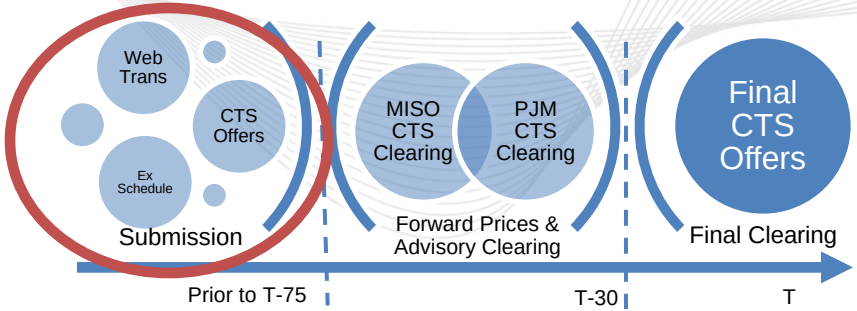
Bidding Options

- Market Participants will have the ability to provide one of three types of bids at the common MISO/PJM interfaces
  - Hourly evaluations of traditional wheel-through transactions (existing)
  - Intra-hour evaluations of traditional LMP Bid/Offers (existing)
  - Intra-hour evaluations of CTS Interface Bid/Offers (new)

CTS Clearing Process

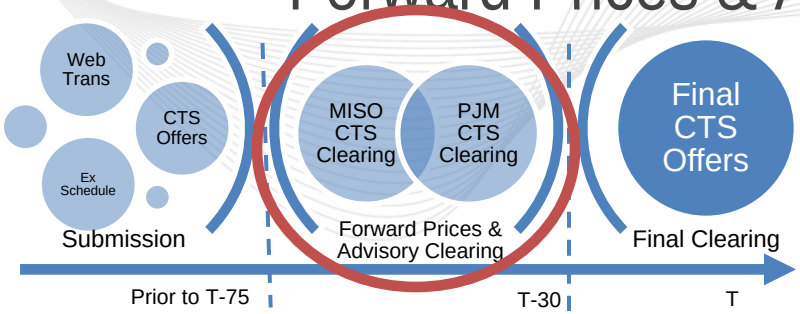


CTS Submission



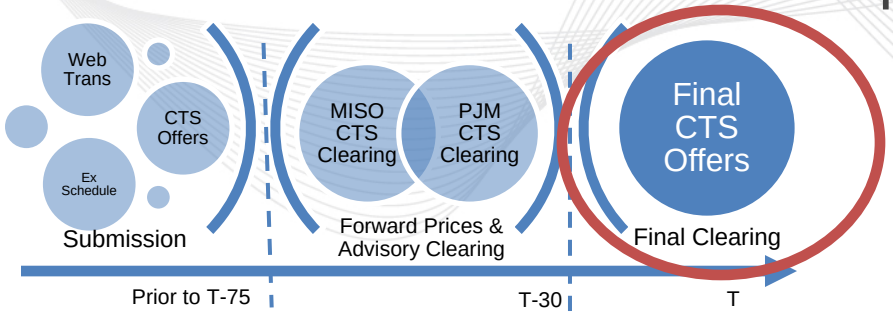
- Transmission Reservation submitted
  - Valid transmission reservation needed in both MISO and PJM
  - Submission timeline is consistent with all other products
- CTS Transaction and associated E-Tag submitted by T-75
  - Consistent with PJM/NYISO CTS submission timeline
  - Ramp request will be time stamped but transaction will not hold ramp until cleared – between T-30 and T-20
  - No changes by Market Participant after T-75
- CTS Bid Curves
  - Bid Curves will either be submitted via the e-Tag or a newly developed common portal

Forward Prices & Advisory Clearing



- The scheduling process will leverage PJM and MISO's forward price projections
- Advisory schedules, in addition to binding schedules, will be exchanged between PJM and MISO
- The most recently available input data will be used to clear the final as well as the advisory CTS schedules

Final Clearing



- Clearing results for CTS Transactions occurs around T-30
  - Only the common set of cleared transactions will remain scheduled, and others will be Market Adjusted
    - Cleared MW volumes will be available in both webTrans and ExSchedule
  - E-Tags will be updated to reflect clearing results
    - Only one system will be responsible for updating the E-Tag
  - Cleared CTS transactions will be included in the ramp calculation

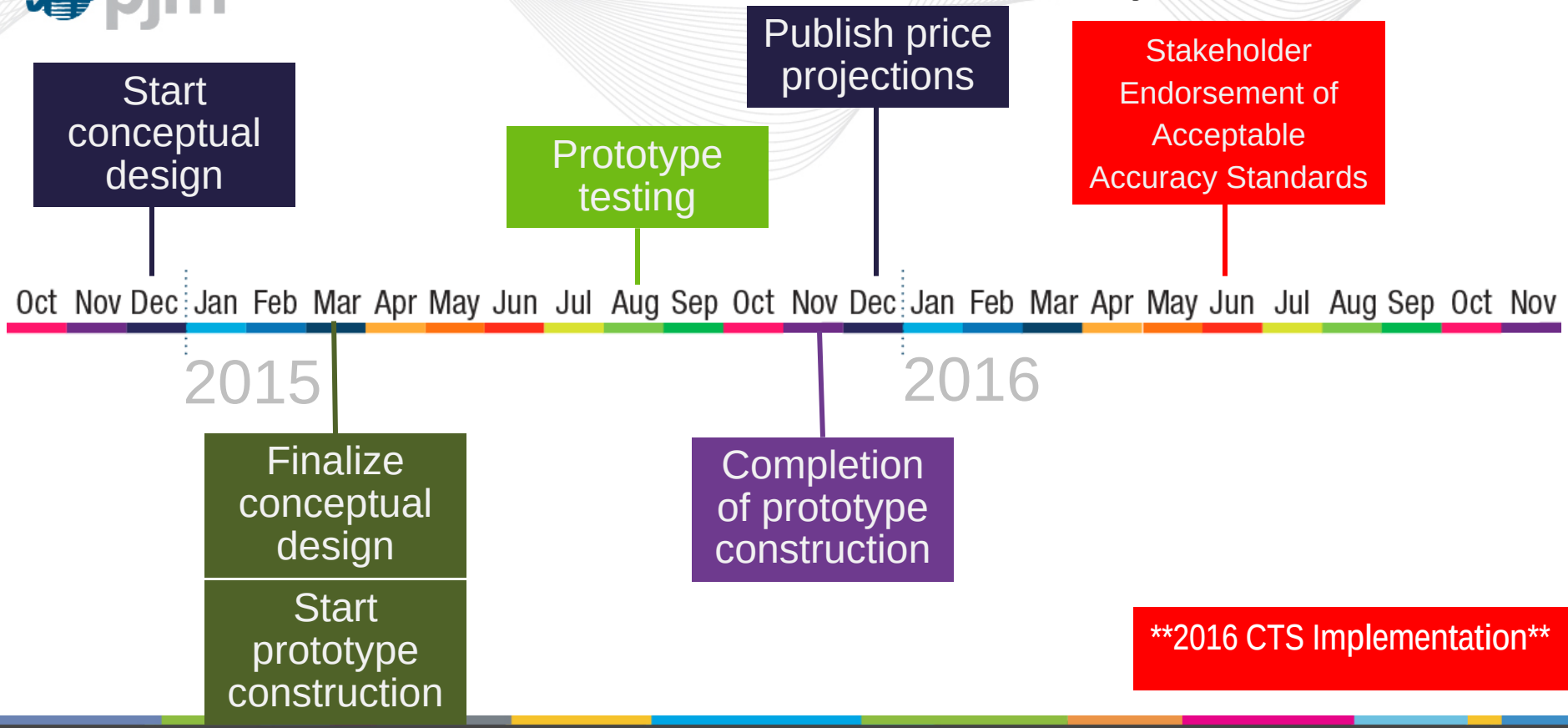
CTS Comparison

Category	PJM/MISO CTS	PJM/NYISO CTS
Transmission Service Request	Required	Required
Ramp Validation	After clearing	After clearing
Submission Timeline	T-75	T-75
Schedule changes	15 minutes	15 minutes
Duration	Hourly	Hourly
Settlement Timeframe	Hourly	Hourly
Make Whole Payment	No	No
Transaction Evaluation	Based on look ahead prices at the seam	Based on look ahead prices at the seam
Clearing Responsibility	MISO and PJM; joint clearing	NYISO

Forward Price Projections

- PJM plans to provide historical price projections and accuracy metrics for the MISO interface
  - Forecasted Interface Prices webpage
  - Data will be inclusive of 2014 and any month in 2015 until which point the values are available in eDatafeed
    - Accuracy metrics for January through November 2014 are included at the end of this presentation
- MISO is currently developing a CTS Engine that will forecast interface prices and clear CTS bids
  - Targeting end of 2015 for publication of forecast interface prices

MISO Forward Price Projection Timeline



JOA/Tariff/Manual Changes

- Tariff/OA
  - No changes beyond those already endorsed for the implementation of CTS between PJM and NYISO
- JOA
  - Definitions
  - Inclusion of Coordinated Transaction Scheduling in Attachment 3 Interregional Coordination Process
- M11 and M41 as appropriate
  - Bid/offer requirements and mechanisms
  - Clearing mechanisms
  - Various updates that reflect the different treatment of CTS transactions as compared to traditional transactions

Proposed Timeline

PJM/MISO CTS Proposal Summary

- CTS will continue to be an optional scheduling product that will extend to the PJM/MISO Interface using an Interface bid/offer
- PJM/MISO CTS Interface bids will be scheduled based on the projected price difference between PJM and MISO at the Interface
- The CTS Credit requirement that was endorsed as part of the PJM/NYISO CTS Proposal will also be applicable to the PJM/MISO CTS product
- Transmission fees and uplift costs are unchanged from today
- CTS Transactions will be settled on an hourly basis in PJM consistent with the current PJM Energy Market settlements
- PJM will provide both historical forecasted MISO interface prices and accuracy metrics until which point the forecasted prices are available in real-time through eDatafeed
- PJM will schedule a vote prior to the implementation of CTS between MISO and PJM to ensure acceptable accuracy standards of forecasted MISO interface prices have been met

MISO IT SCED Accuracy Metrics

January through November 2014

Look Ahead Price Accuracy

- PJM's IT SCED Application provides four look ahead solution intervals over a two hour period
- Analysis was performed to compare the accuracy of the IT SCED forecasted LMPs to the Real Time (RT) LMP at the MISO Interface Pricing Point
  - Data referenced from January through November 2014

	% Occurrence			
Category	Interval 1	Interval 2	Interval 3	Interval 4
> $20	4%	4%	6%	8%
$10 to $20	5%	4%	5%	6%
$5 to $10	7%	7%	8%	7%
$0 to $5	34%	35%	34%	30%
$-5 to $0	33%	33%	31%	31%
$-10 to $-5	7%	7%	7%	7%
$-20 to $-10	5%	5%	5%	5%
< $-20	4%	6%	6%	6%

Look Ahead Price Accuracy Metrics - Monthly

Interval	Category	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
1	> $20	6%	6%	8%	4%	4%	5%	1%	2%	2%	3%	2%
	$10 to $20	6%	6%	9%	8%	8%	5%	4%	2%	3%	5%	4%
	$5 to $10	6%	6%	10%	9%	9%	6%	7%	5%	7%	7%	6%
	$0 to $5	21%	18%	30%	37%	30%	36%	44%	40%	38%	36%	42%
	$-5 to $0	40%	27%	22%	28%	31%	32%	35%	41%	38%	34%	37%
	$-10 to $-5	10%	14%	8%	6%	9%	6%	4%	6%	6%	7%	5%
	$-20 to $-10	6%	13%	7%	5%	5%	5%	3%	3%	4%	5%	3%
	< $-20	5%	9%	6%	2%	4%	5%	2%	2%	2%	3%	2%

Interval	Category	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
2	> $20	6%	9%	9%	4%	4%	4%	1%	1%	1%	2%	1%
	$10 to $20	6%	6%	7%	6%	8%	5%	3%	1%	2%	4%	3%
	$5 to $10	6%	7%	8%	8%	10%	6%	7%	5%	7%	7%	5%
	$0 to $5	24%	19%	30%	37%	31%	35%	44%	41%	40%	37%	43%
	$-5 to $0	36%	25%	23%	31%	28%	32%	35%	41%	37%	34%	36%
	$-10 to $-5	9%	12%	8%	7%	8%	6%	4%	6%	6%	7%	5%
	$-20 to $-10	5%	12%	6%	5%	5%	4%	2%	2%	4%	5%	3%
	< $-20	8%	11%	10%	3%	6%	7%	3%	3%	4%	5%	3%

Look Ahead Price Accuracy Metrics - Monthly

Interval	Category	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
3	> $20	8%	13%	13%	7%	7%	6%	2%	2%	1%	3%	2%
	$10 to $20	6%	6%	6%	7%	9%	5%	5%	3%	3%	4%	3%
	$5 to $10	6%	7%	8%	8%	11%	7%	7%	6%	8%	8%	6%
	$0 to $5	24%	18%	26%	34%	28%	33%	42%	40%	41%	36%	42%
	$-5 to $0	34%	22%	22%	30%	26%	31%	33%	37%	33%	34%	34%
	$-10 to $-5	8%	11%	8%	6%	7%	7%	5%	6%	6%	6%	5%
	$-20 to $-10	5%	11%	6%	5%	5%	5%	3%	3%	4%	4%	3%
	< $-20	9%	11%	10%	4%	7%	7%	4%	3%	4%	5%	4%

Interval	Category	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
4	> $20	10%	19%	16%	10%	12%	10%	6%	7%	2%	3%	3%
	$10 to $20	6%	6%	6%	7%	10%	5%	6%	6%	4%	5%	3%
	$5 to $10	6%	7%	9%	9%	9%	6%	6%	7%	9%	7%	6%
	$0 to $5	23%	16%	23%	29%	27%	29%	39%	33%	36%	31%	37%
	$-5 to $0	33%	20%	21%	30%	24%	30%	32%	36%	35%	37%	38%
	$-10 to $-5	8%	11%	8%	7%	7%	8%	5%	5%	6%	7%	7%
	$-20 to $-10	5%	10%	6%	5%	4%	5%	3%	3%	4%	5%	3%
	< $-20	9%	11%	10%	3%	6%	7%	3%	3%	4%	5%	4%

Look Ahead Price Accuracy Metrics - Seasonal

Interval	Category	Winter	Spring	Summer	Fall
1	> $20	6%	5%	2%	2%
	$10 to $20	6%	8%	4%	4%
	$5 to $10	6%	9%	6%	7%
	$0 to $5	19%	33%	40%	38%
	$-5 to $0	34%	27%	36%	36%
	$-10 to $-5	12%	8%	6%	6%
	$-20 to $-10	9%	5%	4%	4%
	< $-20	7%	4%	3%	2%

Interval	Category	Winter	Spring	Summer	Fall
2	> $20	7%	6%	2%	1%
	$10 to $20	6%	7%	3%	3%
	$5 to $10	6%	9%	6%	6%
	$0 to $5	21%	33%	40%	40%
	$-5 to $0	31%	27%	36%	36%
	$-10 to $-5	10%	7%	6%	6%
	$-20 to $-10	9%	5%	3%	4%
	< $-20	9%	6%	4%	4%

Seasonal Classifications

Winter = January, February

Spring = March, April, May

Summer = June, July, August

Fall = September, October, November

Look Ahead Price Accuracy Metrics - Seasonal

Interval	Category	Winter	Spring	Summer	Fall
3	> $20	10%	9%	3%	2%
	$10 to $20	6%	7%	4%	3%
	$5 to $10	6%	9%	7%	8%
	$0 to $5	21%	30%	39%	40%
	$-5 to $0	28%	26%	34%	34%
	$-10 to $-5	10%	7%	6%	6%
	$-20 to $-10	8%	5%	3%	4%
	< $-20	10%	7%	5%	4%

Interval	Category	Winter	Spring	Summer	Fall
4	> $20	14%	13%	7%	3%
	$10 to $20	6%	8%	6%	4%
	$5 to $10	7%	9%	7%	7%
	$0 to $5	19%	27%	34%	35%
	$-5 to $0	27%	25%	33%	37%
	$-10 to $-5	10%	7%	6%	7%
	$-20 to $-10	8%	5%	4%	4%
	< $-20	10%	6%	4%	4%

Seasonal Classifications

Winter = January, February

Spring = March, April, May

Summer = June, July, August

Fall = September, October, November