

# Uplift Charges, FTR Underfunding and Over-allocation Solutions in PJM

Getting to Yes on Uplift Allocation  
Fixing FTR Funding

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**New York City**

# Discussion Topics

## Uplift allocation, FTR Underfunding and Congestion Imbalances

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- Uplift Allocation
  - Who benefits?
  - Relationship with “Price Formation” problems
  - Cost causation
  - Energy Market Uplift Senior Task Force – time to “get to yes”
- FTR Underfunding
  - First principles: physical = financial
  - Congestion Imbalances and FTR underfunding
  - Relationship between financial trades (incs, decs, UTC) and congestion imbalances

# Uplift Allocation

## What is Uplift?

### ■ What is uplift?:

- “Uplift” = make-whole payments to resources needed to clear the market and meet demand
- Ensures that resources needed by PJM for the market to clear do not lose money

- “Uplift credits are provided to generation or demand resources in certain situations to ensure these resources do not operate at a loss when following PJM dispatch instructions. Generation and demand resources that operate as requested by PJM are entitled, through currently applicable market rules, to recover the full value of their energy offers. In order for PJM to meet this obligation, supplemental compensation in the form of uplift is necessary when the full value of their offers is not recouped through the clearing prices for energy and ancillary services.”

-- PJM Report to the September 8 2014  
“FERC Uplift Workshop,” Docket AD14-14

<http://www.ferc.gov/CalendarFiles/20140905085408-PJM%20%20Whitepaper.pdf>

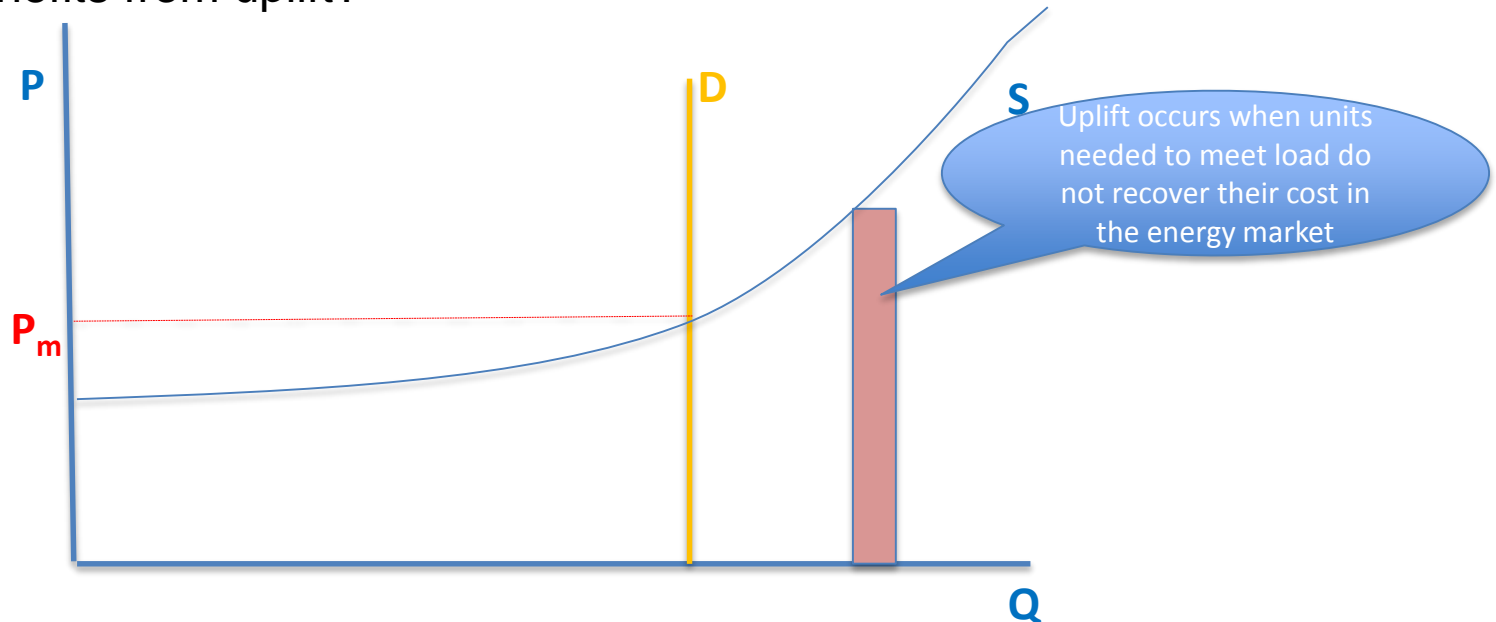
Figure 1: Simple Example of a Resource Requiring Uplift Payments



# Uplift Allocation

## Load Benefits From Uplift

- Who benefits from uplift?



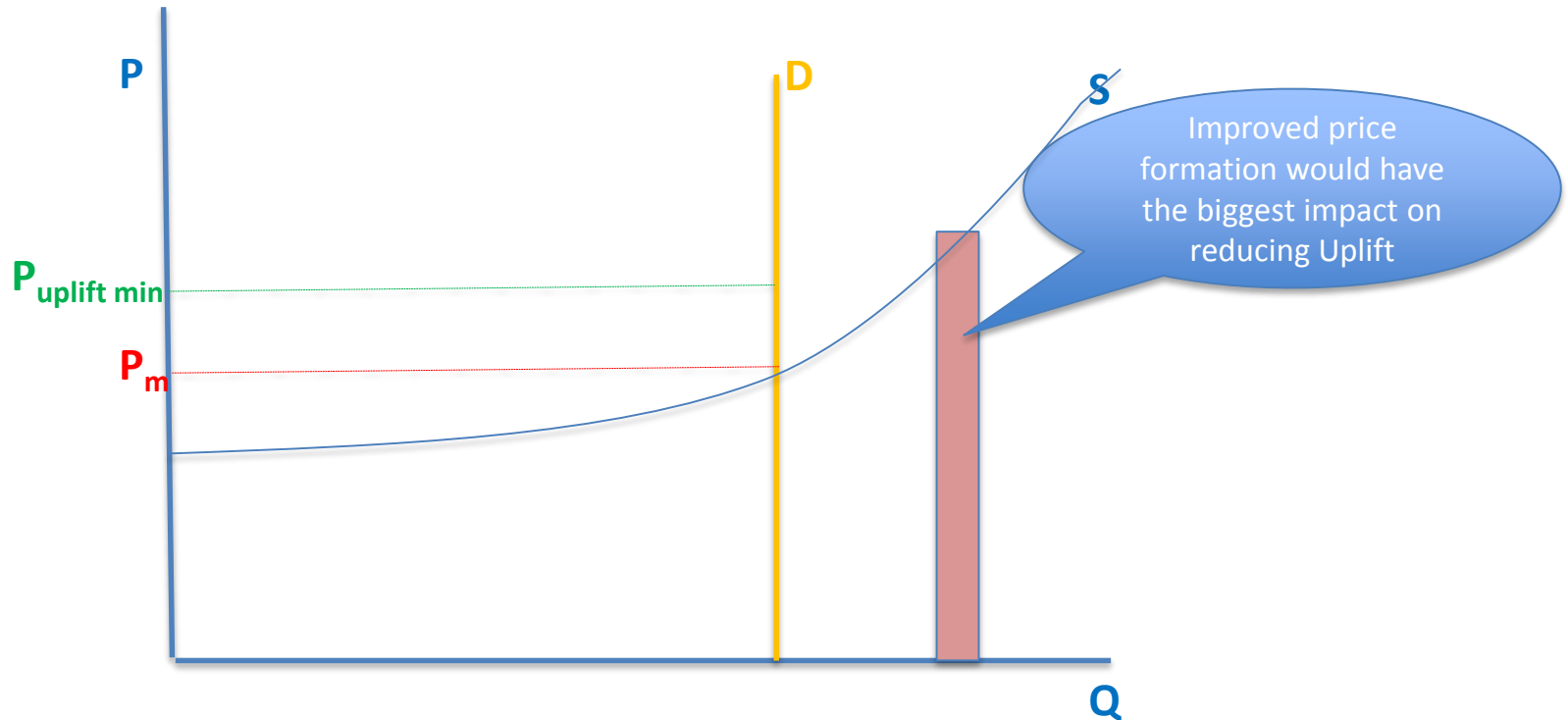
- In a perfect theoretical market, prices would be high enough to fully compensate all generators running to meet load
- Load/buyers benefit from the inherent price suppression implied by the fact that marginal units must be paid outside (and over and above) the normal market price formation mechanism
- But what about load that buys DA with no deviations?
  - Imagine the thought experiment: What if RT imbalances were settled for \$0/MWh?:
  - The existence of uplift in the RT market means that DA and forward market prices are less than they would be without the RT price suppression

# Uplift Allocation

## Need for Improved Price Formation

- Price formation issues in the RT markets are a major contributor to uplift (see FERC Docket AD14-14)
  - Peakers committed and not setting price
  - Peakers unable to adjust bids in RT if costs increase
  - Pricing of shortage events like load reduction
  - Co-optimization of reserves/energy

<http://www.ferc.gov/EventCalendar/EventDetails.aspx?ID=7424&CalType=%20b>



- If RT prices were “right” we’d have much less uplift
  - Prices would be higher
  - Some financial deviations would pay more, some less

# Uplift Allocation

## Charging Financial Bids for Costs They Do Not Cause Reduces Market Efficiency

- Separate from price formation issues, here are some sources of balancing market commitments unrelated to financial bids (many unrelated to deviations):
  - Load forecast error
  - Operator actions out-of-market
  - Local reliability requirements
  - Transmission outages
  - Generator trips
  - Voltage issues
  - Changes in loop flow between DA and RT
- PJM, has been able to reduce uplift merely by reducing their reliance on expensive steam units in the Reliability Commitment, without deviations changing
- Not all deviations are equal – Dr. Patton points out that many financial bids actually improve commitment and reduce overall costs
- Convergence trading (Incs, Decs, UTCs) improves price convergence and market price signals
- Access to the spot market for settling imbalances is important for market efficiency

# Uplift Allocation

## Current PJM Approach

- Current balancing market uplift allocated in a two-stage process:

- Post-DAM Reliability Analysis Commitments

- Units committed for PJM forecast load plus reserves allocated to deviations
- Units committed for “additional reliability margin” to RT load plus exports

- Operating Day Commitments

- Allocated to deviations if unit in merit for four 5-min intervals of any single hour during operating cycle
- If never in merit, allocate to RT load plus exports

Classification of commitments in the reliability pass becomes critical. For instance, how are quick start units classified? What if DA load over-forecasted?

Not clear how this is related to cost causation

# Uplift Allocation

## Market Comparison

### Uplift - What/How Others Are Really Paying

ISO	Live Date	Netting	RT Uplift	Avg \$/MW 2013
ERCOT	Dec-10	YES	Hourly Net short	\$0.02
NYISO	Dec-99	N/A	N/A	N/A
CALISO	Apr-09	YES	Hourly Net short	\$0.26 (FMM)
MISO	Apr-06	YES	DDC: Hourly Net Short	\$1.00 (DDC)
		(MARKET WIDE)	CMC: Hourly Net Flows	\$0.02 (CMC)
PJM	Jun-00	Yes for Physical	Daily Abs MW	\$3.28 (East)
		No for Financial		\$1.65 (West)
SPP	Mar-14	NO	Daily Abs MW	\$1.82 (H1 2014)





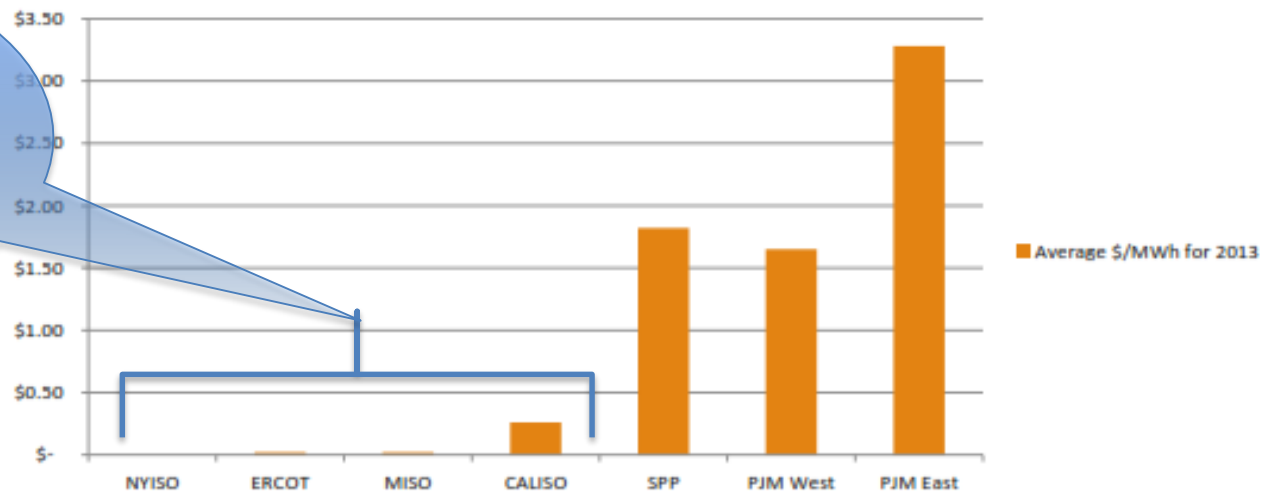
# Uplift Allocation

## Market Comparison

### How PJM Really Stacks Up!!

Markets with structures that facilitate convergence trading

Average Uplift \$/MWh for 2013



\*Note: SPP has same Market Design and uplift allocation as PJM (H1 2014)



# Uplift Allocation

## Balancing OR Uplift Charge Rates Are High Because “Deviations” Represent a Small Denominator

- Given the lack of precise cost causation, allocating uplift to deviations creates a vicious cycle as market participants go to extreme and unnecessary lengths to balance their schedules
- The problem is the small denominator in the deviation uplift rate combined with the high uplift charges. (Tables below for Jan 2013-June 2014)
- This led PJM to initially propose a “single rate” option as the potential solution (i.e. peanut butter to all)

### Allocation Breakdown

#### • Day-Ahead Operating Reserve

Denominator	Daily Average (MWh)	Share
Day-Ahead Load	2,077,265	91.3%
Day-Ahead Exports	33,606	1.5%
DECs	164,597	7.2%
Total	2,275,467	100.0%

#### • Balancing Operating Reserve (Reliability)

Denominator	Daily Average (MWh)	Share
Real-Time Load	2,137,415	97.0%
Real-Time Exports	66,929	3.0%
Total	2,204,344	100.0%

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### Allocation Breakdown

#### • Balancing Operating Reserve (Deviations)

Deviations	Daily Average (MWh)	Share
Load Only	134,101	38.9%
Generators	87,698	25.5%
Imports/Exports Only	38,592	11.2%
DECs/INCs Only	39,282	11.4%
IBT's Only	5,015	1.5%
Combination with DEC/INC	27,140	7.9%
Combination without DEC/INC	12,665	3.7%
Total	344,493	100.0%

# Uplift Allocation

## PJM Energy Market Uplift Senior Task Force

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- PJM Energy Market Uplift Task Force has come up with multiple proposals
  - PJM and MMU both recommend eliminating the netting of IBTs and inclusion of UTC transactions to increase the denominator
  - FERC has initiated 206 filing (EL14-37) on whether UTCs should be included in uplift allocation
  - After initially proposing a single rate for all uplift and getting little traction, PJM has now proposed minor modifications to the existing uplift allocation methodology
- Time for “Getting to Yes” on Uplift Allocation
- MMU proposal may be a basis for moving forward
- PJM original “single rate” approach also worth revisiting
- There has been a lot of substantive work done for the stakeholder process

# Uplift Allocation

## MMU Proposal

- MMU proposal may be a basis for moving forward
  - Can we better classify commitments in the Reliability Commitment Analysis?
    - Avoid tagging quick start units as “caused by” deviations; these units are available in both the DA and Reliability Commitment as well as in the Operating Day and should set price if they are called on
    - Can we identify when commitments caused by load over-forecast?
    - Can we better identify which deviations are contributing to the need for reliability commitments?
  - Should “During Operating Day” Deviations be allocated across load as well as the new “physical deviation” category

## MMU Allocation Proposal

New Energy Uplift Category	Charges (\$MM)	Share	Charges excluding Jan	
			2014 (\$MM)	Share
Day-Ahead Segment	\$73.0	7.0%	\$44.9	9.5%
Reliability	\$346.3	33.4%	\$14.8	3.1%
Before Operating Day Deviation	\$259.8	25.0%	\$200.2	42.2%
During Operating Day Deviation	\$358.8	34.6%	\$214.2	45.2%
Total	\$1,038.0	100.0%	\$474.2	100.0%

Allocated to an improved deviation definition: Excluding IBTs, including wheels and UTCs.

Allocated to a new deviation definition (physical): Load, generators and interchange deviations.

# FTR Underfunding

## First Principles: Physical = Financial

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- FTR Underfunding
  - First principles: financial = physical
  - Congestion Imbalances and FTR underfunding
  - Relationship between financial trades (incs, decs, UTC) and congestion imbalances
- Revenue Adequacy Theorem
  - As long as financial rights do not exceed the physical capacity of the system, then the ISO will always collect enough “congestion rents” from the operation of the spot market to fund the financial rights
  - Therefore:
    - Match DA transfer capability with RT transfer capability
    - Match annual FTR auction financial rights with DA transfer capability
    - If these things happen, there is no FTR underfunding

# FTR Underfunding

## Spinning Out of Control

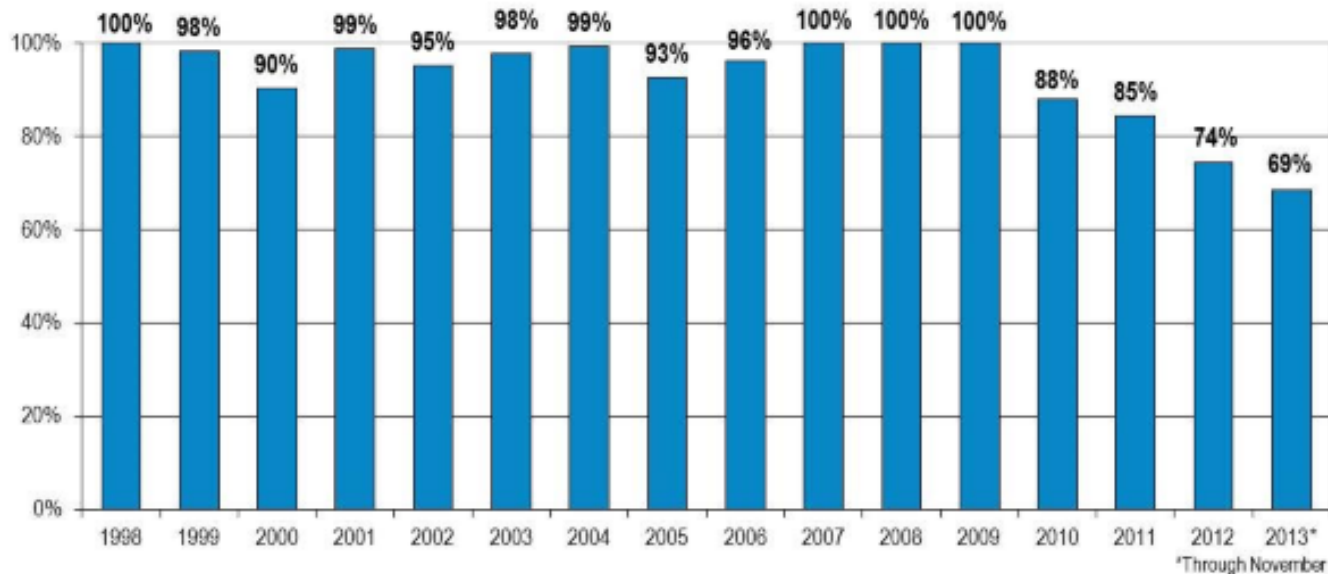


Figure 42. PJM Calendar Year FTR Payout Ratio

<http://www.pjm.com/Search%20Results.aspx?q=September%202013%20heat%20wave>

- Underfunding has grown increasingly problematic
- Large underfunding levels represent a serious market design problem

# FTR Underfunding

## Spinning Out of Control

- Balancing congestion represents a major portion of FTR underfunding since 2010:

Planning Period	Revenue Adequacy	Total Surplus	Day-Ahead Surplus	Auction Surplus	Balancing Congestion	M2M Payments
2009-10	97%	-\$28	\$58	\$92	-\$148	-\$31
2010-11	85%	-\$254	\$36	\$67	-\$316	-\$48
2011-12	81%	-\$192	\$34	\$109	-\$255	-\$80
2012-13	69%	-\$288	-\$2	\$67	-\$329	-\$45
2013-14	72%	-\$677	-\$348	\$76	-\$376	-\$44
2014-15*	103%	\$2	\$21	\$2	-\$18	-\$2

\*through June 2014

- “Negative Balancing Congestion has been the *largest contributor to FTR underfunding during 2010-2014* (~90 percent or ~\$1.28 of ~\$1.41 billion during Jun 2010 – May 2014)”
  - Harry Singh, September 17, 2014 presentation to FTRSTF
  - <http://www.pjm.com/~media/committees-groups/task-forces/ftrstf/20140917/20140917-more-questions-on-fters.ashx>
- PJM is the only market which allocates congestion imbalances back to FTRs

# FTR Underfunding

## ATSI Interface and September 2013 Heat Wave

- Prices in the ATSI Zone spiked to \$1800/MWh with PJM calling the ATSI Interface constraint so that prices inside the ATSI Zone would correspond to operator actions

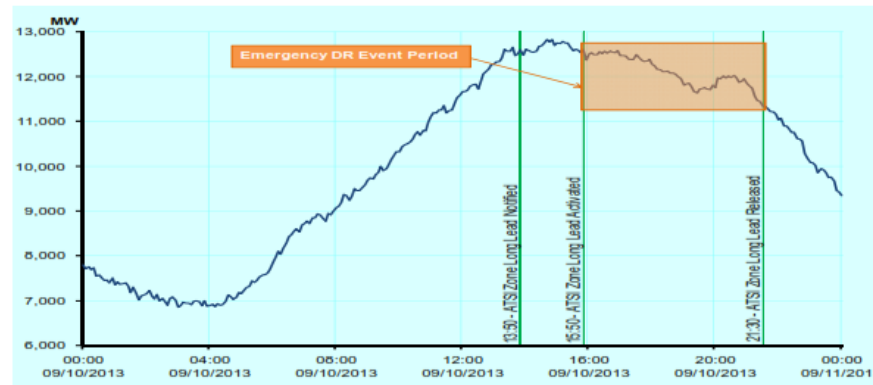


Figure 15. September 10 load curve with long lead emergency load management event

<http://www.pjm.com/Search%20Results.aspx?q=September%202013%20heat%20wave>

- The high ATSI prices resulted in congestion imbalances during the price spike, entirely erasing FTR funding during many high priced hours
- I.e. -- during the hours when the PJM market as a whole was at it's most stressed in 2013 – exactly at the moment when market participants are most relying on the FTR product to provide a hedge for LMP congestion risk – FTRs were 0% funded in PJM



# FTR Underfunding

## Congestion Imbalances Caused by Reliability Actions

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*“Under the current market rules, FTR holders can be adversely impacted significantly by such emergency procedures taken to maintain system reliability when they have no impact to the Real-Time Market or system operations. PJM believes that this is a flaw in the market design that needs to be addressed.”*

-- PJM statement from December 23, 2013 *Technical Analysis of Operational Events and Market Impacts During the September 2013 Heat Wave*. P. 92

# FTR Underfunding

## Generalizing From ATSI to Other Operator Actions That Result in Congestion Imbalances

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- PJM has begun to use tightening RT transfer capability to solve price formation problems
  - ATSI Interface
  - Use of “closed loop” interfaces to allow price setting to avoid uplift
  - Other potential solutions to price formation issues
- If congestion imbalances are needed for PJM to “get the prices right,” these costs would be more appropriately charged back to load as a reliability charge
  - These costs are due to PJM needing to have a better price formation mechanisms, not due to an actual decrease in available transmission capacity
  - The costs do not relate to FTRs
  - As an alternative, the charges could be allocated to all DA demand inside the interface (load plus net financial demand including UTCs)

# FTR Underfunding and Congestion Imbalances

## Do Financial Trades Cause Congestion Imbalances?

- Congestion imbalances only exist if RT transfer capability < DA transfer capability
  - If RT physical = DA financial, no imbalance
  - “Cause” of imbalance is the decrease in transfer capability, not financial trades
  - When RT transfer capability is reduced, UTC and other financial trades will profit from the resulting RT price spikes
    - Correlation is not causality
    - Negative congestion balance would have been identical regardless of financial as long as the constraint would have bound in the DA market but for the financial trades
      - Very strong correlation – classic case of spurious correlation
      - Driver of congestion imbalances is decrease in transfer capability (due to change in transmission topology or loop flow)
- Do financial trades contribute to congestion imbalances when there is a reduction in RT transfer capability?:
  - In many circumstances, no!
  - If constraint would have bound in DA without financial trades, then congestion imbalance is unchanged by presence/absence of financial trades
    - This is true even if the financial trades worsen the DA congestion
  - Financial trade only exacerbates congestion imbalance if the financial trades are adding flow on the constraint path in the DA market (i.e. the constraint would not have otherwise bound in DA market, or would have had reduced flow in the DA market but for the financial trades)

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# Appendix

## Financial Trades and Congestion Imbalances

Is there a “causal” relationship?

# Financial Trades and Congestion Imbalances

## Is there a “causal” relationship?

- Do financial trades (incs, decs, UTC) cause congestion imbalances?
- Framework: evaluate 8 hypothetical cases:
  - With and without financial trades
  - With and without reduced transfer capacity
  - With and without DA constraint limiting but for financial trades

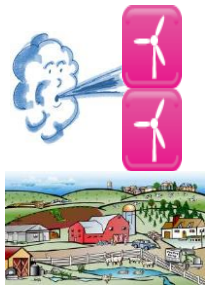
Evaluate Day-Ahead Congestion Rents (funds FTRs) and Congestion Imbalances			
		Convergence Bidding	
		No	Yes
<i>Transmission Topology</i>	RT transfer capability = DA transfer capability	Case 1	Case 2
	RT transfer capability < DA transfer capability	Case 3	Case 4

- Conclusion -- when negative congestion balance occurs and DA market would have been congested:
  - No causality from virtual trades
  - Very strong correlation – classic case of spurious correlation
  - Driver of congestion imbalances is decrease in transfer capability (due to change in transmission topology or loop flow)
  - Financial trade only exacerbates congestion imbalance if the constraint would not have otherwise bound in DA market

# Financial trades' impact on congestion imbalances

## Case 1: No convergence bids; no decrease in transmission capability

### UpstreamTown

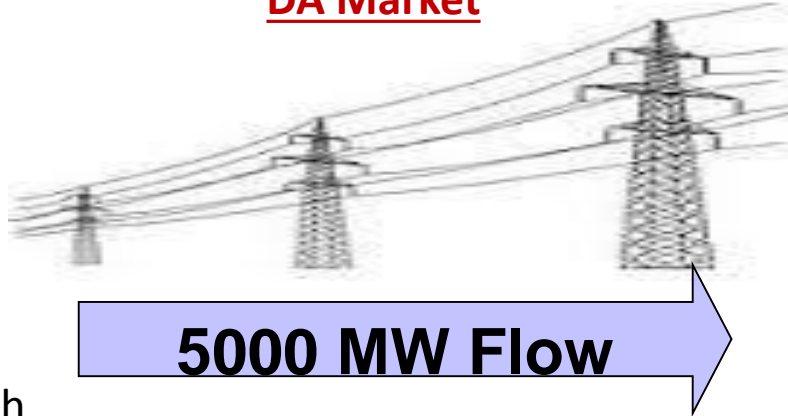


Up Gen  
9000 MW

Up Load  
4000 MW

$P_{up} = \$30/\text{MWh}$

### DA Market



### DownstreamTown

DownGen  
3900 MW

100 MW

0 MW

DownLoad  
9000 MW

$P_{down} = \$40/\text{MWh}$



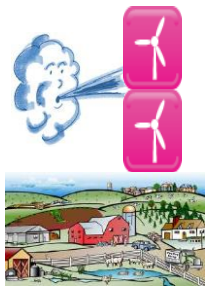
DownGenA

DownGenB



In the real-time market, DownGenA trips and is replaced by DownGenB

### UpstreamTown

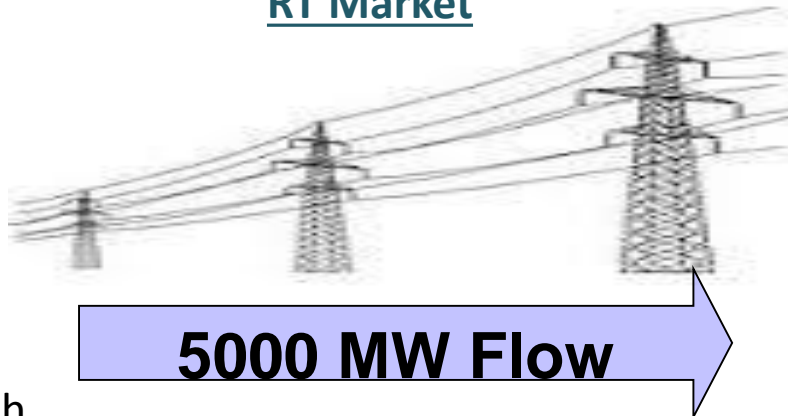


Up Gen  
9000 MW

Up Load  
4000 MW

$P_{up} = \$30/\text{MWh}$

### RT Market



### DownstreamTown

DownGen  
3900 MW

0 MW

100 MW

DownLoad  
9000 MW

$P_{down} = \$60/\text{MWh}$



DownGenA

DownGenB



# Financial trades' impact on congestion imbalances

## Case 1: No convergence bids; no decrease in transmission capability

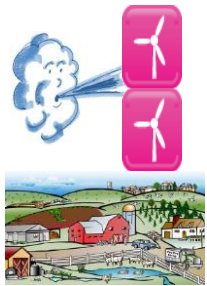
Case 1: Calculation of Day-Ahead Market Congestion Rents and Real-time Market Congestion Imbalances									
	Day-Ahead			Real-Time			Schedule Deviation		
	Q	P	Total	Q	P	Total	Q	P	Total
UpGen	9000	30	(270,000)	9000	30		-	30	-
DownGen	3900	40	(156,000)	3900	60		-	60	-
DownGenA	100	40	(4,000)	0	60		(100)	60	6,000
DownGenB	0	40	-	100	60		100	60	(6,000)
Upload	4000	30	120,000	4000	30		-	30	-
Download	9000	40	360,000	9000	60		-	60	-
Flow/FTR	5000	10	50,000	5000	30		-	60	-
ISO Collections (from Load)			480,000						-
Net ISO Payments (to Gen)			(430,000)						-
DA Congestion Rent			50,000						
Congestion Imbalance									-

- ISO collects \$50,000 (5000 MW \* \$10) in Congestion Rents to fund FTRs
- In the real-time balancing market, ISO payments from DownGenA exactly offset payments to DownGenB. There are no congestion imbalances

# Financial trades' impact on congestion imbalances

## Case 2: 500 MW of Inc and Decs; no decrease in transmission capability

### UpstreamTown



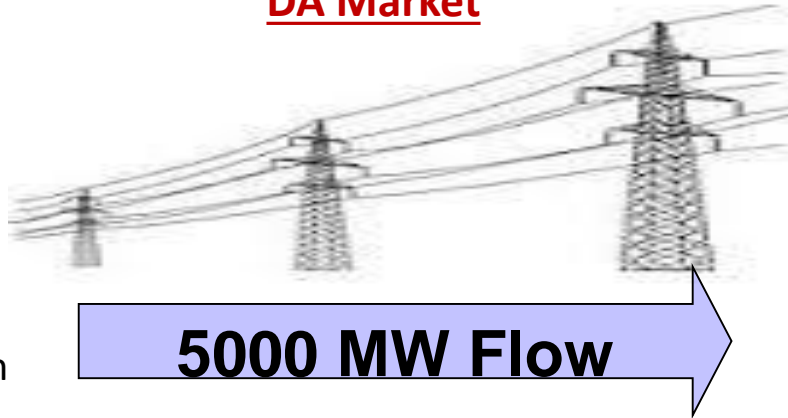
Up\_Gen  
8500 MW

UpInc  
500 MW

Up\_Load  
4000 MW

$P_{up} = \$25/\text{MWh}$

### DA Market



### DownstreamTown



DownGen  
3900 MW

100 MW  
0 MW

DownGenA  
DownGenB

DownDec  
500 MW

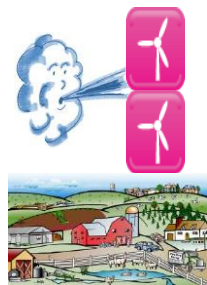
DownLoad  
8500 MW



$P_{down} = \$45/\text{MWh}$

In the real-time market, DownGenA trips and is replaced by DownGenB, upstream Inc's are replaced by upstream Gen, downstream Decs are replaced by downstream load

### UpstreamTown



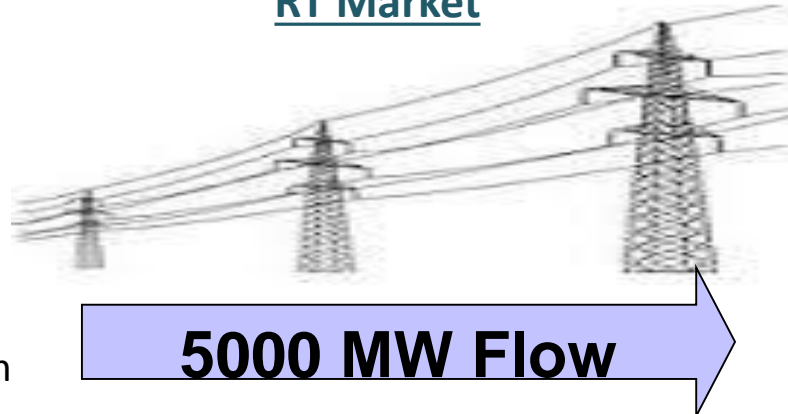
Up\_Gen  
9000 MW

UpInc  
0 MW

Up\_Load  
4000 MW

$P_{up} = \$30/\text{MWh}$

### RT Market



### DownstreamTown



DownGen  
3900 MW

100 MW  
0 MW

DownGenA  
DownGenB

DownDec  
0 MW

DownLoad  
9000 MW



$P_{down} = \$60/\text{MWh}$



# Financial trades' impact on congestion imbalances

## Case 2: 500 MW of Inc and Decs; no decrease in transmission capability

Case 2: Calculation of Day-Ahead Market Congestion Rents and Real-time Market Congestion Imbalances

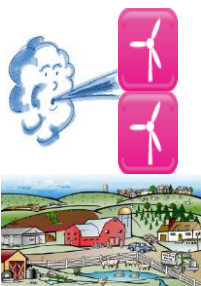
	Day-Ahead			Real-Time			Schedule Deviation		
	Q	P	Total	Q	P	Total	Q	P	Total
UpGen	8500	25	(212,500)	9000	30		500	30	(15,000)
UpInc	500	25	(12,500)	0	30		(500)	30	15,000
DownGen	3900	45	(175,500)	3900	60		-	60	-
DownGenA	100	45	(4,500)	0	60		(100)	60	6,000
DownGenB	0	45	-	100	60		100	60	(6,000)
Upload	4000	25	100,000	4000	30		-	30	-
Download	8500	45	382,500	9000	60		500	60	30,000
DownDec	500	45	22,500	0	60		(500)	60	(30,000)
Flow/FTR	5000	20	100,000	5000	30		-	30	-
ISO Collections (from Load)			505,000						-
Net ISO Payments (to Gen)			(405,000)						-
DA Congestion Rent			100,000						
Congestion Imbalance									-

- ISO collects \$100,000 (5000 MW \* \$20) in Congestion Rents to fund FTRs
- In the real-time balancing market, ISO receipts and payments offset. There are no congestion imbalances
- Financial trades profit \$5000 (\$15 gain on dec; \$5 loss on inc)

# Financial trades' impact on congestion imbalances

## Case 3: No convergence bids; transmission capability reduced 1000

### UpstreamTown

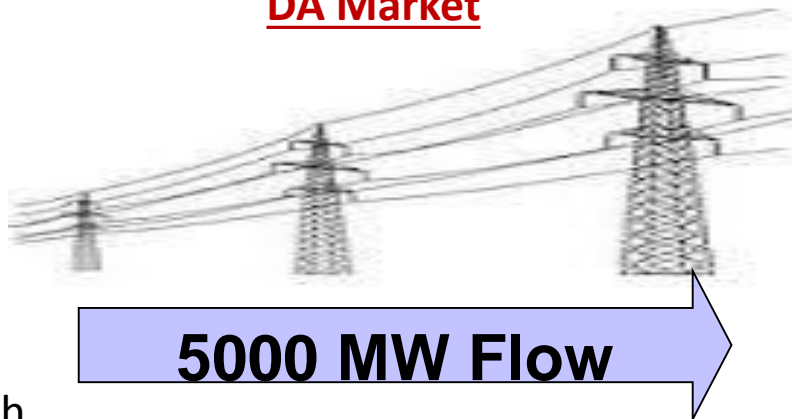


Up Gen  
9000 MW

Up Load  
4000 MW

$P_{up} = \$30/\text{MWh}$

### DA Market



### DownstreamTown

DownGen  
3900 MW

100 MW

0 MW

DownLoad  
9000 MW

$P_{down} = \$40/\text{MWh}$



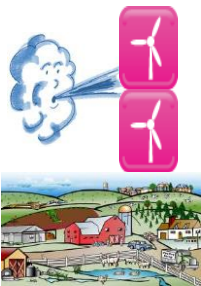
DownGenA

DownGenB



In the real-time market, DownGenA trips and is replaced by DownGenB; transmission capacity is reduced by 1000 MW resulting in required redispatch (decrease Gen in UpstreamTown; increase Gen in downstreamTown)

### UpstreamTown

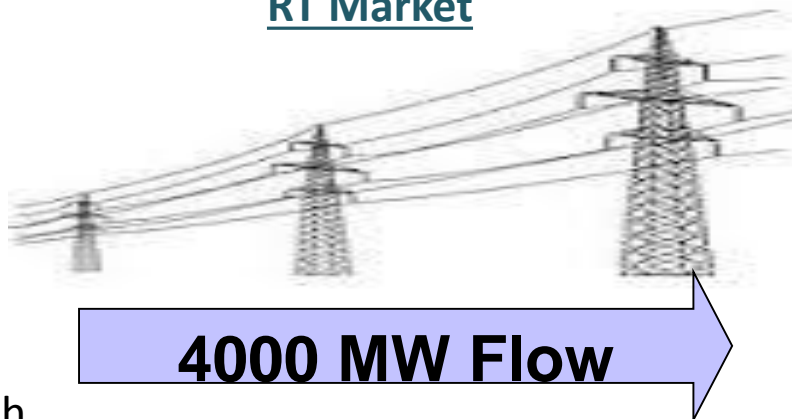


Up Gen  
8000 MW

Up Load  
4000 MW

$P_{up} = \$20/\text{MWh}$

### RT Market



### DownstreamTown

DownGen  
4900 MW

0 MW

100 MW

DownLoad  
9000 MW

$P_{down} = \$100/\text{MWh}$



DownGenA

DownGenB



# Financial trades' impact on congestion imbalances

## Case 3: No convergence bids; transmission capability reduced 1000

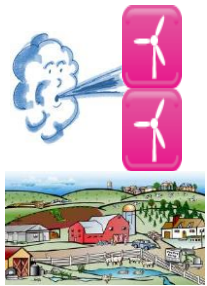
Case 3: Calculation of Day-Ahead Market Congestion Rents and Real-time Market Congestion Imbalances									
	Day-Ahead			Real-Time			Schedule Deviation		
	Q	P	Total	Q	P	Total	Q	P	Total
UpGen	9000	30	(270,000)	8000	20		(1,000)	20	20,000
DownGen	3900	40	(156,000)	4900	100		1,000	100	(100,000)
DownGenA	100	40	(4,000)	0	100		(100)	100	10,000
DownGenB	0	40	-	100	100		100	100	(10,000)
UpLoad	4000	30	120,000	4000	20		-	20	-
DownLoad	9000	40	360,000	9000	100		-	100	-
Flow/FTR	5000	10	50,000	4000	80		(1,000)	80	
ISO Collections (from Load)			480,000						-
Net ISO Payments (to Gen)			(430,000)						(80,000)
DA Congestion Rent			50,000						
Congestion Imbalance									(80,000)

- ISO collects \$50,000 (5000 MW \* \$10) in Congestion Rents to fund FTRs
- In the real-time balancing market, ISO must make additional congestion imbalance payments of \$80,000 for redispatch caused by the change in transmission topology.

# Do financial trades impact congestion imbalances?

## Case 4: 500 MW of Inc and Decs; transmission capability reduced 1000

### UpstreamTown



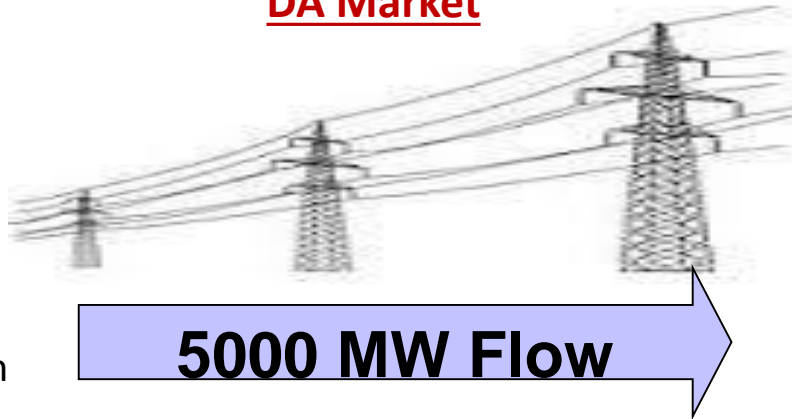
Up\_Gen  
8500 MW

UpInc  
500 MW

Up\_Load  
4000 MW

$P_{up} = \$25/\text{MWh}$

### DA Market



### DownstreamTown



DownGen  
3900 MW

100 MW  
0 MW

DownDec  
500 MW

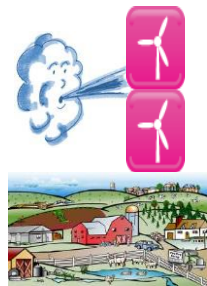
DownLoad  
8500 MW

$P_{down} = \$45/\text{MWh}$



In the real-time market, DownGenA trips and is replaced by DownGenB, upstream Incs are replaced by upstream Gen, downstream Decs are replaced by downstream load; transfer capability reduced 1000 MW

### UpstreamTown



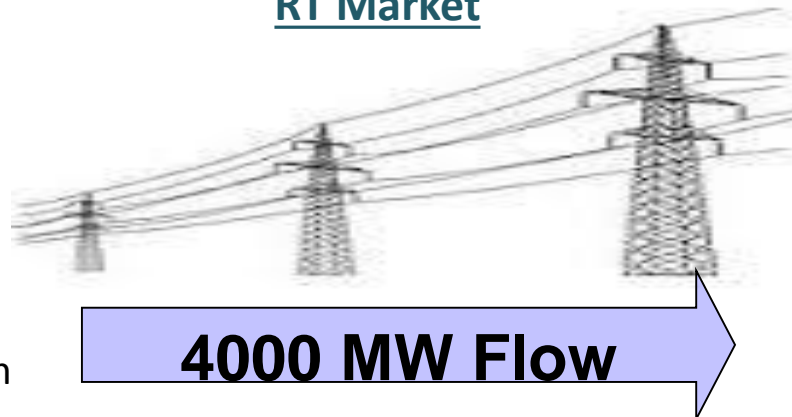
Up\_Gen  
8000 MW

UpInc  
0 MW

Up\_Load  
4000 MW

$P_{up} = \$20/\text{MWh}$

### RT Market



### DownstreamTown



DownGen  
3900 MW

100 MW  
0 MW

DownDec  
0 MW

DownLoad  
9000 MW

$P_{down} = \$100/\text{MWh}$



# Do financial trades impact congestion imbalances?

## Case 4: 500 MW of Inc and Decs; transmission capability reduced 1000

Case 4: Calculation of Day-Ahead Market Congestion Rents and Real-time Market Congestion Imbalances										
	Day-Ahead			Real-Time			Schedule Deviation			
	Q	P	Total	Q	P	Total	Q	P	Total	
UpGen	8500	25	(212,500)	8000	20		(500)	20	10,000	
UpInc	500	25	(12,500)	0	20		(500)	20	10,000	
DownGen	3900	45	(175,500)	4900	100		1,000	100	(100,000)	
DownGenA	100	45	(4,500)	0	100		(100)	100	10,000	
DownGenB	0	45	-	100	100		100	100	(10,000)	
Upload	4000	25	100,000	4000	20		-	20	-	
Download	8500	45	382,500	9000	100		500	100	50,000	
DownDec	500	45	22,500	0	100		(500)	100	(50,000)	
Flow/FTR	5000	20	100,000	4000	80		(1,000)	80	(80,000)	
ISO Collections (from Load)			505,000						-	
Net ISO Payments (to Gen)			(405,000)						(80,000)	
DA Congestion Rent			100,000							
Congestion Imbalance									(80,000)	

- ISO collects \$100,000 (5000 MW \* \$20) in Congestion Rents to fund FTRs
- In the real-time balancing market, ISO must make additional congestion imbalance payments of \$80,000 for redispatch caused by the change in transmission topology.
- Financial trades profit \$30,000 ((\$55 gain on dec; \$5 gain on inc)

# Financial Trades and Congestion Imbalances

Is there a “causal” relationship?

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- When negative congestion balance occurs and DA market would have been congested:
  - No causality from virtual trades
  - Very strong correlation – classic case of spurious correlation
  - Driver of congestion imbalances is decrease in transfer capability (due to change in transmission topology or loop flow)