#### PJM Bill Does Not Include Actual Congestion Paid

# AFMTF March 25, 2020

**Howard Haas** 



**Monitoring Analytics** 

- PJM Bill includes:
  - Charges to load based on LMP
  - Credit to generation based on LMP
  - Charges to load based on CLMP
  - Credits to generation based on CLMP
  - CLMP indicates whether the LMP paid or credited is higher or lower than the reference bus price.
  - Nothing less. Nothing more.
- The PJM bill does not include the amount of congestion paid by the participant.





- Customer A has 1 MW of load. LMP of \$15, CLMP of \$10.
- Customer A paid \$10 in CLMP related charges
- Customer A paid \$5 in system energy (SMP) related charges
- Customer A has a total energy bill of \$15

	Load MW	Gen MW	CLMP Load Charges	CLMP Gen Credits	Net Energy Charges (SMP)	Total Bill
Customer A	1	0	\$5	\$0	\$10	\$15

- How much congestion did Customer A pay?
  - Cannot tell from the PJM bill.



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• Self supply through resource ownership or contract will affect the PJM bill but not the congestion paid.



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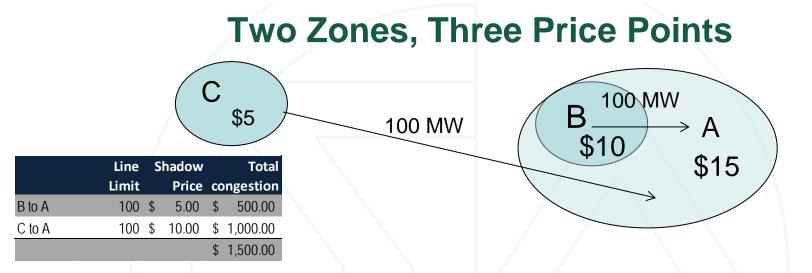
- Customer A has 1 MW of load and 2 MW of generation. LMP of \$15, CLMP of \$10.
- Customer A paid \$10 in CLMP related charges and was credited \$20 in CLMP related charges.
- Customer A paid \$5 in energy (SMP) related charges and was credited \$10 in energy (SMP) related charges
- Customer A Customer A is charged \$15 for energy and credited \$30 for energy, Net -\$15.

			CLMP Load	CLMP Gen	Net Energy	
	Load MW	Gen MW	Charges	Credits	Charges (SMP)	Total Bill
Customer A	1	2	\$5	\$10	(\$10)	(\$15)

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- How much congestion did Customer A pay?
  - Cannot tell from the PJM bill.

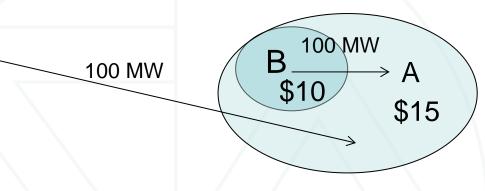




- Congestion is the difference between what load pays and generation is paid.
- Congestion is known from the information provided.
- If the information is the result of a security constrained optimization, the components of LMP and the load and gen MW at A, B and C and who owns the load or gen does not affect the amount of congestion paid.



#### **Two Zones, Three Price Points**



				_	
	Line	S	hadow		Total
	Limit		Price	СС	ongestion
B to A	100	\$	5.00	\$	500.00
C to A	100	\$	10.00	\$	1,000.00
				\$	1,500.00

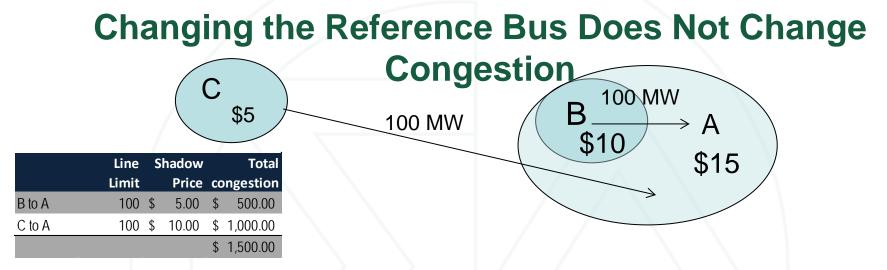
	SMP	CLMP	LMP
А	\$ 15.00	\$ -	\$ 15.00
В	\$ 15.00	\$ (5.00)	\$ 10.00
С	\$ 15.00	\$ (10.00)	\$ 5.00

- LMP is a result of the optimization solution
- CLMP is defined relative to the reference bus.
- PJM uses a load weighted reference bus
- The LMP at load weighted reference bus= SMP
- SMP = load weighted average price to load
- + CLMP indicates LMP higher than SMP

\$5

- CLMP indicates LMP lower than SMP





	SMP	CLMP	LMP	Load	Gen
А	\$ 15.00	\$ -	\$ 15.00	250	50
В	\$ 15.00	\$ (5.00)	\$ 10.00	0	100
С	\$ 15.00	\$ (10.00)	\$ 5.00	0	100
				SMP	15

	SMP	CLMP	LMP	Load	Gen
А	\$10.00	\$5.00	\$15.00	250	50
В	\$10.00	\$0.00	\$10.00	250	350
С	\$10.00	-\$5.00	\$5.00	250	350
				SMP	10

- + CLMP indicates LMP higher than SMP
- CLMP indicates LMP lower than SMP

## **CLMP Is Not Congestion**

	Line	S	hadow	Total			
	Limit		Price	СС	ongestion		
B to A	100	\$	5.00	\$	500.00		
C to A	100	\$	10.00	\$	1,000.00		
				\$	1,500.00		

		7								Total LMP			
								Load SMP	CLMP load	Load	Gen SMP	CLMP Gen	Total LMP
	SMP		CLMP	LMP	Load	Gen	Bus	Charges	charges	Charges	Credits	Credits	Gen Credits
А	\$ 15.00	\$	-	\$ 15.00	250	50	А	\$3,750.00	\$0.00	\$3,750.00	\$750.00	\$0.00	\$750.00
В	\$ 15.00	\$	(5.00)	\$ 10.00	0	100	В	\$0.00	\$0.00	\$0.00	\$1,500.00	-\$500.00	\$1,000.00
С	\$ 15.00	\$	(10.00)	\$ 5.00	0	100	С	\$0.00	\$0.00	\$0.00	\$1,500.00	-\$1,000.00	\$500.00
							Totals	\$3,750.00	\$0.00	\$3,750.00	\$3,750.00	-\$1,500.00	\$2,250.00

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	Total System Congestion	Total System Surplus (Charges - Credits)
Load Charges	\$0.00	\$3,750.00
Generation Credits	-\$1,500.00	\$2,250.00
Total	\$1,500.00	\$1,500.00

Load and Gen Changed CLMP changed Congestion did not



## **CLMP Is Not Congestion**

	Line	S	hadow	Total			
	Limit		Price	СС	ongestion		
B to A	100	\$	5.00	\$	500.00		
C to A	100	\$	10.00	\$	1,000.00		
				\$	1,500.00		

			_					Total LMP			
						Load SMP	CLMP load	Load	Gen SMP	CLMP Gen	Total LMP
SMP	CLMP	LMP	Load	Gen	Bus	Charges	charges	Charges	Credits	Credits	Gen Credits
\$10.00	\$5.00	\$15.00	250	50	А	\$2,500.00	\$1,250.00	\$3,750.00	\$500.00	\$250.00	\$750.00
\$10.00	\$0.00	\$10.00	250	350	В	\$2,500.00	\$0.00	\$2,500.00	\$3,500.00	\$0.00	\$3,500.00
\$10.00	-\$5.00	\$5.00	250	350	С	\$2,500.00	-\$1,250.00	\$1,250.00	\$3,500.00	-\$1,750.00	\$1,750.00
					Totals	\$7,500.00	\$0.00	\$7,500.00	\$7,500.00	-\$1,500.00	\$6,000.00
	\$10.00 \$10.00	\$10.00 \$5.00 \$10.00 \$0.00	\$10.00 \$5.00 \$15.00 \$10.00 \$0.00 \$10.00	\$10.00 \$5.00 \$15.00 250 \$10.00 \$0.00 \$10.00 250	\$10.00 \$5.00 \$15.00 250 50 \$10.00 \$0.00 \$10.00 250 350	\$10.00 \$5.00 \$15.00 250 50 A   \$10.00 \$0.00 \$10.00 250 350 B   \$10.00 -\$5.00 \$5.00 250 350 C	SMPCLMPLMPLoadGenBusCharges\$10.00\$5.00\$15.0025050A\$2,500.00\$10.00\$0.00\$10.00250350B\$2,500.00\$10.00-\$5.00\$5.00250350C\$2,500.00	SMPCLMPLMPLoadGenBusChargescharges\$10.00\$5.00\$15.0025050A\$2,500.00\$1,250.00\$10.00\$0.00\$10.00250350B\$2,500.00\$0.00\$10.00-\$5.00\$5.00250350C\$2,500.00-\$1,250.00	SMP   CLMP   LMP   Load   Gen   Bus   Load SMP   CLMP load   Load     \$10.00   \$5.00   \$15.00   250   50   A   \$2,500.00   \$1,250.00   \$3,750.00     \$10.00   \$0.00   \$10.00   250   350   B   \$2,500.00   \$1,250.00   \$2,500.00     \$10.00   \$0.00   \$10.00   250   350   B   \$2,500.00   \$1,250.00   \$2,500.00     \$10.00   -\$5.00   \$5.00   \$5.00   \$5.00   \$1,250.00   \$1,250.00   \$1,250.00	SMP   CLMP   LMP   Load   Gen   Bus   Charges   Charges	SMP   CLMP   LMP   Load   Gen   MP   CLMP Gen     \$10.00   \$5.00   \$15.00   250   50   A   \$2,500.00   \$1,250.00   \$3,750.00   \$500.00   \$250.00   \$250.00   \$1,250.00   \$3,750.00   \$3,500.00   \$250.00   \$2,500.00   \$1,250.00   \$3,500.00   \$2,500.00   \$1,250.00   \$3,500.00   \$2,500.00   \$1,250.00   \$3,500.00   \$1,250.00   \$3,500.00   \$1,750.00   \$1,250.00   \$1,250.00   \$3,500.00   \$1,750.00   \$1,250.00   \$1,250.00   \$1,250.00   \$3,500.00   \$1,750.00   \$1,250.00

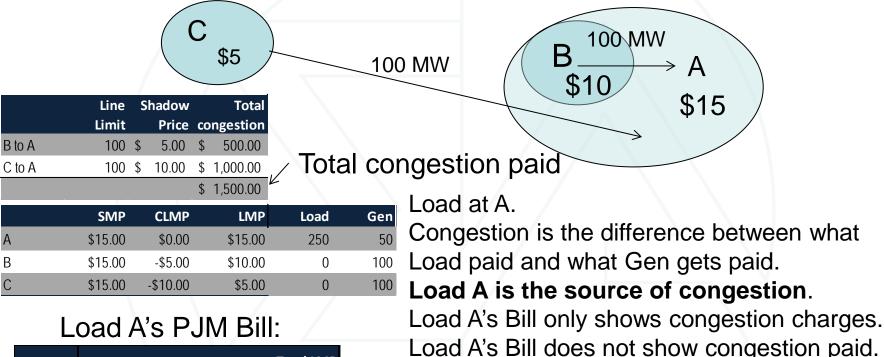
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	Total System Congestion	Total System - Surplus (Charges Credits)
Load Charges	\$0.00	\$7,500.00
Generation Credits	-\$1,500.00	\$6,000.00
Total	\$1,500.00	\$1,500.00

Load and Gen Changed CLMP changed Congestion did not



#### Simple Model



			Total LMP	
	Load SMP	CLMP load	Load	
Bus	Charges	charges	Charges	
А	\$3,750.00	\$0.00	\$3,750.00	-

Charges <> congestion, note CLMP charges = \$0



В

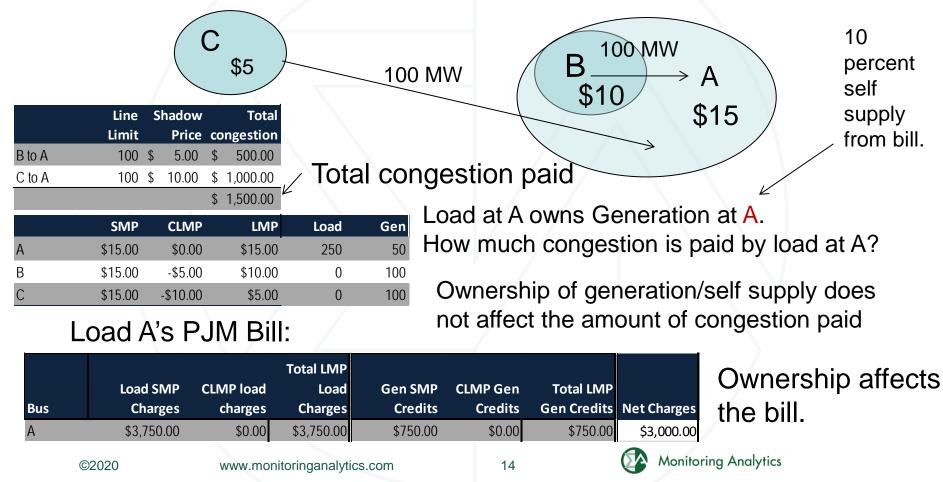
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#### Changing the Reference Bus Does Not Change Congestion 100 MW B \$5 100 MW Α \$10 \$15 Shadow Total Line Limit **Price congestion** B to A 100 \$ 500.00 5.00 Total congestion paid \$ 1,000.00 C to A 100 \$ 10.00 \$ 1,500.00 Load at A. Gen SMP CLMP LMP Load Congestion is the difference between what 50 \$10.00 \$5.00 \$15.00 250 250 В \$10.00 \$0.00 \$10.00 350 Load paid and what Gen gets paid. -\$5.00 250 350 \$10.00 \$5.00 Load A is the source of congestion. Load A's Bill only shows congestion charges. Load A's PJM Bill: Load A's Bill does not show congestion paid. **Total LMP** Load SMP **CLMP** load Load Bus Charges charges Charges Charges <> congestion, note CLMP charges > \$0 \$1,250.00 \$2,500.00 \$3,750.00

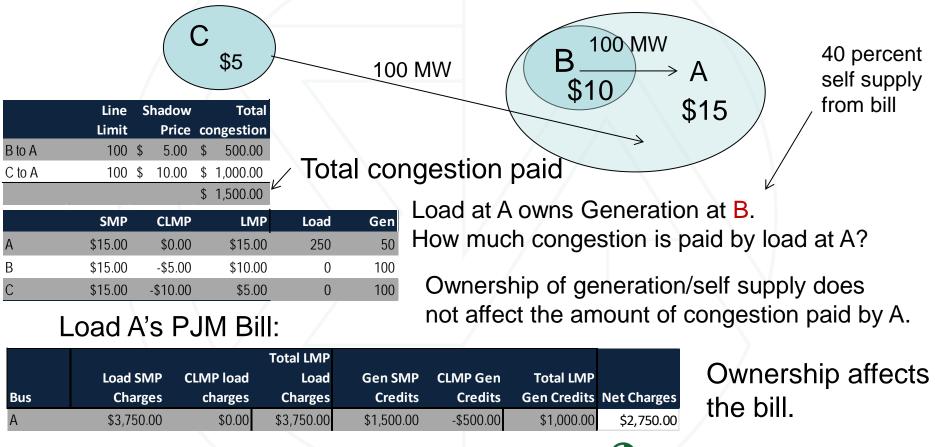
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	H	listo	orical	Relat	tio	onships Do Not Determine
B to A	Line Limit 100	Shadow Price	C \$5 Total congestion \$ 500.00		С	O MW B 100 MW A \$10 \$15
C to A	100		\$ 1,000.00	/ Total	cor	ongestion paid
			\$ 1,500.00			
	SMP	CLMP	LMP	Load	Gen	
A	\$15.00	\$0.00	\$15.00	250	50	
B C	\$15.00 \$15.00	-\$5.00 -\$10.00	\$10.00 \$5.00	0	100 100	
	Load	A's P	JM Bill			The historical relationship does
	Loa	d SMP	CLMP load	Total LMP Load		not affect the amount of congestion paid
<b>Bus</b> A		<b>harges</b> ,750.00	charges \$0.00	Charges \$3,750.00	_ C	Charges <> congestion, note CLMP charges = \$0
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#### **Contracts Affect the Bill, Not Congestion**

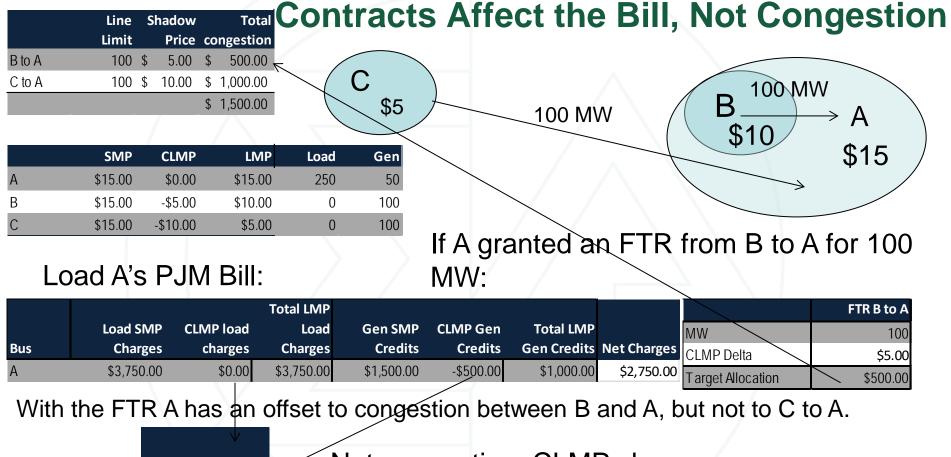


#### **Contracts Affect the Bill, Not Congestion**



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More genera	tion,	ontrac	ts Aff	ect th	he Bi	II, Not	Conges	tion
more lo same conges	bad,	C \$5		100 M	IW /	/( B	0 MW →→ A	100+ percent self supply from bill
J	Line Sha	dow Total				\$10	\$15	(supplying
		Price congestion					ΨιΟ	spot too), <u>not</u>
B to A		5.00 \$ 500.00	Tata		<b>1</b> :		-	/ from actual
C to A	100 \$ 10	0.00 \$ 1,000.00	, Iota	I cong	estion	paid —		network use.
	$\downarrow$	≥ \$ 1,500.00			oad at A	owns Gene	eration at B. $^{\prime}$	
	SMP C	LMP LMP	Load	Gon			n is paid by lo	ad at A?
А	\$10.00 \$	5.00 \$15.00	250	∖ 50		rcongestio	in is paid by it	
В	\$10.00 \$	\$0.00 \$10.00	250	350		المالية	to oborona :	
С	\$10.00 -\$	\$5.00 \$5.00	250	000			•	n output from gen.
	oad A's	PJM Bil	I:	1	No char	ige in con	gestion paid	by A.
	Load SMP	CLMP load	Total LMP		CLMP Gen	Total LMP		nership affects
Bus	Charges	charges	Load Charges	Gen SMP Credits	Credits	Gen Credits No		
A	\$2,500.00	\$1,250.00	\$3,750.00	\$3,500.00	\$0.00	\$3,500.00	\$250.00 × the	e bill.
C	02020	www.mon	itoringanalytics	.com	16		Monitoring Ana	lytics



Not congestion, CLMP charges

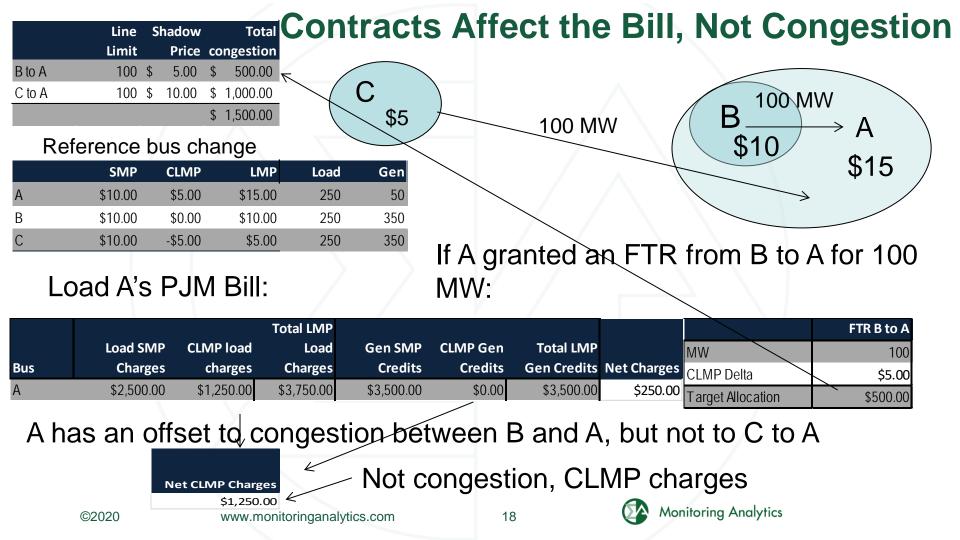
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Net CLMP Charges

\$500.00

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#### Resource Ownership and Contracts Do Not Affect Actual Congestion

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**Monitoring Analytics** 

- The following examples show a two bus model with 2 generators and 2 load serving entities at each bus.
- The examples show that the components of LMP change with a change in the reference bus, but the congestion collected from each LSE is not affected by changes in the reference bus.
- The examples show that the components of the PJM bill will change with the reference bus, but the total charges or credits to each LSE or generator will not change.





- The examples show that ownership of generation resources at either bus will change an LSE's PJM bill but will not change the amount of congestion paid by that LSE.
- Self supply affects the PJM bill but does not affect the congestion paid by an LSE.
- The examples show that congestion is the difference between what load is paying for energy and payments to generation that serves that load through network service.





				Transfer Lin	nit A to B	50			
Zone A		SMP	CLMP	LMP	Zone B		SMP	CLMP	LMP
Price Com	ponent	\$50.00	-\$25.00	\$25.00	Price Comp	oonents	\$50.00	\$25.00	\$75.00
Gen			Credits		Gen			Credits	
Zone A	MW	SMP	CLMP	Total	Zone B	MW	SMP	CLMP	Total
Gen 1A		\$0.00	\$0.00	\$0.00	Gen 1B	100	\$5,000.00	\$2,500.00	\$7,500.00
Gen 2A	200	\$10,000.00	-\$5,000.00	\$5,000.00	Gen 2B		\$0.00	\$0.00	\$0.00
Total Gen	200	\$10,000.00	-\$5,000.00	\$5,000.00	Total Gen	100	\$5,000.00	\$2,500.00	\$7,500.00
Load			Charges		Load			Credits	
Zone A		SMP	CLMP	Total	Zone B		SMP	CLMP	Total
Load 1A	75	\$3,750.00	-\$1,875.00	\$1,875.00	Load 1B	75	\$3,750.00	\$1,875.00	\$5,625.00
Load 2A	75	\$3,750.00	-\$1,875.00	\$1,875.00	Load 2B	75	\$3,750.00	\$1,875.00	\$5,625.00
Total Load	150	\$7,500.00	-\$3,750.00	\$3,750.00	Total Load	150	\$7,500.00	\$3,750.00	\$11,250.00
Net by "Zo	one"	-\$2,500.00	\$1,250.00	-\$1,250.00			\$2,500.00	\$1,250.00	\$3,750.00
	Т	otal				-			

Load 1B's PJM Bill: \$5,625 for energy.

PJM bill does not indicate the amount of congestion paid into PJM system.

Load 1B paid more for energy than the generation that served 1B via network was paid.

Load 1B paid congestion.

Load 1B and 2B paid all congestion.

(	5	
	E	

Amount of

Constraint

+CLMP related due to

50% \$

50% \$

Congestion paid

1,250.00

1,250.00

\$12,500.00

\$15,000.00

\$2,500.00

\$2,500.00

\$

50.00

Zone B

Load 1B

Load 2B

Total Load

Total Gen

Congeston

Shadow Price

Line Limit

**Total Congestion** 

Charges

Credits

CLMP from

bus)

Constraint (Move

the reference

22

CLMP Charges Proportion of

charges

From

\$50.00

\$50.00

Constraint

\$3,750.00

\$3,750.00

				Transfer Lir	nit A to B	50					
Zone A		SMP	CLMP	LMP	Zone B		SMP		CLMP	LMP	
Price Comp	ponent	\$25.00	\$0.00	\$25.00	Price Con	nponents	\$2	5.00	\$50.0	00 \$75	5.00
Gen			Credits		Gen			Credits			
Zone A	MW	SMP	CLMP	Total	Zone B	MW	SMP		CLMP	Total	
Gen 1A		\$0.00	\$0.00	\$0.00	Gen 1B	100	\$2,50	0.00	\$5,000.0	0 \$7,500	0.00
Gen 2A	200	\$5,000.00	\$0.00	\$5,000.00	Gen 2B		\$	0.00	\$0.0	)0 \$(	0.00
Total Gen	200	\$5,000.00	\$0.00	\$5,000.00	Total Ger	n 100	\$2,50	0.00	\$5,000.0	0 \$7,500	0.00
Load			Charges		Load				Credits	5	
Zone A		SMP	CLMP	Total	Zone B		SMP		CLMP	Total	
Load 1A	75	\$1,875.00	\$0.00	\$1,875.00	Load 1B	75	\$1,87	5.00	\$3,750.0	00 \$5,625	5.00
Load 2A	75	\$1,875.00	\$0.00	\$1,875.00	Load 2B	75	\$1,87	5.00	\$3,750.0	0 \$5,625	5.00
Total Load	150	\$3,750.00	\$0.00	\$3,750.00	Total Loa	d 150	\$3,75	0.00	\$7,500.0	00 \$11,250	0.00
Net by "Zo	ne"	-\$1,250.00	\$0.00	-\$1,250.00			\$1,25	0.00	\$2,500.0	0 \$3,750	0.00
	Т	otal	Moving	the refe	rence b	us does	s not c	char	nge cor	ngestion	
Total Load Charges Total Gen		\$12,500.00		CLMP from Constrain the refer	nt (Move	CLMP Cha From	-			Amount of Congestior due to	
Credits		\$15,000.00	Zone B	bus)		Constrain	t ch	arges	5	Constraint	
Congesto	n	\$2,500.00	Load 1B		\$50.00	\$3,75	50.00		50%	\$ 1,2	250.00
Shadov	w Price	\$ 50.00	Load 2B		\$50.00	\$3,75	50.00		50%	\$ 1,2	250.00
Line Total Cor	Limit	50 \$2,500.00	www.m	onitoringana	lytics.com		23				Monit

Load 1B's PJM Bill: \$5,625 for energy.

PJM bill does not indicate the amount of congestion paid into PJM system.

Load 1B paid more for energy than the generation that served 1B via network was paid.

Load 1B paid congestion.

Load 1B and 2B paid all congestion.



				Transfer Lin	nit A to B	50			
Zone A		SMP	CLMP	LMP	Zone B		SMP	CLMP	LMP
Price Com	ponent	\$50.00	-\$25.00	\$25.00	Price Comp	onents	\$50.00	\$25.00	\$75.00
Gen			Credits		Gen			Credits	
Zone A	MW	SMP	CLMP	Total	Zone B	MW	SMP	CLMP	Total
Gen 1A		\$0.00	\$0.00	\$0.00	Gen 1B	100	\$5,000.00	\$2,500.00	\$7,500.00
Gen 2A	200	\$10,000.00	-\$5,000.00	\$5,000.00	Gen 2B		\$0.00	\$0.00	\$0.00
Total Gen	200	\$10,000.00	-\$5,000.00	\$5,000.00	Total Gen	100	\$5,000.00	\$2,500.00	\$7,500.00
Load			Charges		Load			Credits	
Zone A		SMP	CLMP	Total	Zone B		SMP	CLMP	Total
Load 1A	75	\$3,750.00	-\$1,875.00	\$1,875.00	Load 1B	75	\$3,750.00	\$1,875.00	\$5,625.00
Load 2A	75	\$3,750.00	-\$1,875.00	\$1,875.00	Load 2B	75	\$3,750.00	\$1,875.00	\$5,625.00
Total Load	150	\$7,500.00	-\$3,750.00	\$3,750.00	Total Load	150	\$7,500.00	\$3,750.00	\$11,250.00
Net by "Zo	ne"	-\$2,500.00	\$1,250.00	-\$1,250.00			\$2,500.00	\$1,250.00	\$3,750.00
	Тс	otal	7						

Load 1A's PJM Bill: \$1,875 for energy.

PJM bill does not indicate the amount of congestion paid into PJM system.

Load 1A did not pay more for energy than the energy that served it, via network, got paid.

Load 1A did not pay congestion.

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\$12,500.00

\$15,000.00 Zone B

50.00

\$2,500.00

\$

\$2,500.00 Load 1A

Load 2A

Total Load

Charges

Credits

Total Gen

Congeston

Shadow Price

Line Limit

**Total Congestion** 

**CLMP** from

Constraint



CLMP Charges Proportion of

\$0.00

\$0.00

charges

From

\$0.00

\$0.00

Constraint

Amount of

Constraint

+CLMP related due to

0%

0% \$

\$

**Congestion** paid

					Transfer Lin	nit A to B	50					
Zone A		SMP	CLMP		LMP	Zone B		SMP		CLMP	LN	1P
Price Comp	onent	\$25.00	( 1	\$0.00	\$25.00	Price Cor	nponents		\$25.00	\$50.	00	\$75.00
Gen			Cred	its		Gen				Credit	s	
Zone A 🛛 🛚	MW	SMP	CLMP		Total	Zone B	MW	SMP		CLMP	То	tal
Gen 1A		\$0.00	( 1	\$0.00	\$0.00	Gen 1B	100	\$2,	500.00	\$5,000.	00	\$7,500.00
Gen 2A	200	\$5,000.00	( 1	\$0.00	\$5,000.00	Gen 2B			\$0.00	\$0.	00	\$0.00
Total Gen	200	\$5,000.00	C T	\$0.00	\$5,000.00	Total Ger	ו 100	\$2,	500.00	\$5,000.	00	\$7,500.00
Load			Charg	ges		Load				Credit	s	
Zone A		SMP	CLMP		Total	Zone B		SMP		CLMP	То	tal
Load 1A	75	\$1,875.00	( 1	\$0.00	\$1,875.00	Load 1B	75	\$1,	875.00	\$3,750.	00	\$5,625.00
Load 2A	75	\$1,875.00	0	\$0.00	\$1,875.00	Load 2B	75	\$1,	875.00	\$3,750.	00	\$5,625.00
Total Load	150	\$3,750.00	( 1	\$0.00	\$3,750.00	Total Loa	d 150	\$3,	750.00	\$7,500.	00 \$	511,250.00
Net by "Zor	ne"	-\$1,250.00	4	\$0.00	-\$1,250.00			\$1,	250.00	\$2,500.	00	\$3,750.00
	Тс	otal	] Mo	ving	the refe	rence b	ous does	s no	t chai	nge co	nge	stion
Total Load											Amoı	unt of
Charges		\$12,500.00	D				CLMP Cha	rges	Proport	tion of	Cong	estion paid
Total Gen					CLMP fror	n	From	·	+CLMP	related	due t	0
Credits		\$15,000.00	Zone	В	Constrain	t	Constraint	t (	charges	5	Const	traint
Congestor	۱ L	\$2,500.00	) Load 2	1A		\$0.00	\$	0.00		0%	\$	-
Shadow	/ Price	\$ 50.00	Load 2	2A		\$0.00	\$	0.00		0%	\$	-
Line L		50										

Load 1A's PJM Bill: \$1,875 for energy.

PJM bill does not indicate the amount of congestion paid into PJM system.

Load 1A did not pay more for energy than the energy that served it, via network, got paid.

Load 1A did not pay congestion.

\$2,500.00

**Total Congestion** 

					Transfer Lin	nit A to B	50			
Zone A		SMP	CLMP		LMP	Zone B		SMP	CLMP	LMP
Price Com	ponent	\$25.00		\$0.00	\$25.00	Price Comp	ponents	\$25.00	\$50.00	\$75.00
Gen			Crea	dits		Gen			Credits	
Zone A	MW	SMP	CLMP		Total	Zone B	MW	SMP	CLMP	Total
Gen 1A		\$0.00		\$0.00	\$0.00	Gen 1B	100	\$2,500.00	\$5,000.00	\$7,500.00
Gen 2A	200	\$5,000.00		\$0.00	\$5,000.00	Gen 2B		\$0.00	\$0.00	\$0.00
Total Gen	200	\$5,000.00		\$0.00	\$5,000.00	Total Gen	100	\$2,500.00	\$5,000.00	\$7,500.00
Load			Char	rges		Load			Credits	
Zone A		SMP	CLMP		Total	Zone B		SMP	CLMP	Total
Load 1A	75	\$1,875.00		\$0.00	\$1,875.00	Load 1B	75	\$1,875.00	\$3,750.00	\$5,625.00
Load 2A	75	\$1,875.00		\$0.00	\$1,875.00	Load 2B	75	\$1,875.00	\$3,750.00	\$5,625.00
Total Load	150	\$3,750.00		\$0.00	\$3,750.00	Total Load	150	\$3,750.00	\$7,500.00	\$11,250.00
Net by "Zo	one"	-\$1,250.00		\$0.00	-\$1,250.00			\$1,250.00	\$2,500.00	\$3,750.00
	Т	otal								

Load 1A's PJM Bill: \$1,875 for energy.

Load 1A buys Gen 2A. Gen 2A is paid \$5,000

PJM bill does not indicate the amount of congestion paid into PJM system.

Load 1A did not pay congestion. Gen 2A was paid LMP for its output.

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\$12,500.00

\$15,000.00 Zone B

50.00

\$2,500.00

\$

\$2,500.00 Load 1A

Load 2A

Total Load

Total Gen

Congeston

Shadow Price

Line Limit

**Total Congestion** 

Charges

Credits

**CLMP** from

Constraint

26

charges

CLMP Charges Proportion of

\$0.00

\$0.00

From

\$0.00

\$0.00

Constraint

Amount of

Constraint

+CLMP related due to

0%

0% \$

\$

**Congestion** paid

					Transfer Lin	nit A to B	50			
Zone A		SMP	CLMP		LMP	Zone B		SMP	CLMP	LMP
Price Com	ponent	\$25.00		\$0.00	\$25.00	Price Comp	onents	\$25.00	\$50.00	\$75.00
Gen			Cred	lits		Gen			Credits	
Zone A	MW	SMP	CLMP		Total	Zone B	MW	SMP	CLMP	Total
Gen 1A		\$0.00		\$0.00	\$0.00	Gen 1B	100	\$2,500.00	\$5,000.00	\$7,500.00
Gen 2A	200	\$5,000.00		\$0.00	\$5,000.00	Gen 2B		\$0.00	\$0.00	\$0.00
Total Gen	200	\$5,000.00		\$0.00	\$5,000.00	Total Gen	100	\$2,500.00	\$5,000.00	\$7,500.00
Load			Char	ges		Load			Credits	
Zone A		SMP	CLMP		Total	Zone B		SMP	CLMP	Total
Load 1A	75	\$1,875.00		\$0.00	\$1,875.00	Load 1B	75	\$1,875.00	\$3,750.00	\$5,625.00
Load 2A	75	\$1,875.00		\$0.00	\$1,875.00	Load 2B	75	\$1,875.00	\$3,750.00	\$5,625.00
Total Load	150	\$3,750.00		\$0.00	\$3,750.00	Total Load	150	\$3,750.00	\$7,500.00	\$11,250.00
Net by "Zo	one"	-\$1,250.00		\$0.00	-\$1,250.00			\$1,250.00	\$2,500.00	\$3,750.00
	Т	otal	7					Y /		

Load 1B's PJM Bill: \$5,625 for energy.

Load 1B buys Gen 2A Gen 2A gets paid \$5,000 Load 1B's Net PJM Bill: \$625.

PJM bill does not indicate the amount of congestion paid into PJM system.

Load 1B paid congestion. Load 2B paid <u>the same</u> amount of congestion.

Load 1B and 2B paid all congestion.

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\$12,500.00

\$15,000.00

\$2,500.00

\$2,500.00

\$

50.00

50

Zone B

Load 1B

Load 2B

Total Load

Total Gen

Congeston

Shadow Price

Line Limit

**Total Congestion** 

Charges

Credits

CLMP from

bus)

Constraint (Move

the reference



CLMP Charges Proportion of

charges

From

\$50.00

\$50.00

Constraint

\$3,750.00

\$3,750.00

Amount of

Constraint

+CLMP related due to

50% \$

50% \$

Congestion paid

1,250.00

1,250.00

					Transfer Lin	nit A to B	50			
Zone A		SMP	CLMP		LMP	Zone B		SMP	CLMP	LMP
Price Com	ponent	\$25.00		\$0.00	\$25.00	Price Comp	ponents	\$25.00	\$50.00	\$75.00
Gen			Cred	dits		Gen			\$25.00 \$50.00 \$75.00   Credits   AP CLMP Total   \$2,500.00 \$5,000.00 \$7,500.00   \$0.00 \$0.00 \$0.00   \$2,500.00 \$5,000.00 \$7,500.00   \$2,500.00 \$5,000.00 \$7,500.00   \$2,500.00 \$5,000.00 \$7,500.00   \$2,500.00 \$5,000.00 \$7,500.00   \$2,500.00 \$5,000.00 \$5,600.00   \$1,875.00 \$3,750.00 \$5,625.00   \$1,875.00 \$3,750.00 \$5,625.00	
Zone A	MW	SMP	CLMP		Total	Zone B	MW	SMP	CLMP	Total
Gen 1A	200	\$5,000.00		\$0.00	\$5,000.00	Gen 1B	100	\$2,500.00	\$5,000.00	\$7,500.00
Gen 2A	0	\$0.00		\$0.00	\$0.00	Gen 2B		\$0.00	\$0.00	\$0.00
Total Gen	200	\$5,000.00		\$0.00	\$5,000.00	Total Gen	100	\$2,500.00	\$5,000.00	\$7,500.00
Load			Char	ges		Load			Credits	
Zone A		SMP	CLMP		Total	Zone B		SMP	CLMP	Total
Load 1A	75	\$1,875.00		\$0.00	\$1,875.00	Load 1B	75	\$1,875.00	\$3,750.00	\$5,625.00
Load 2A	75	\$1,875.00		\$0.00	\$1,875.00	Load 2B	75	\$1,875.00	\$3,750.00	\$5,625.00
Total Load	150	\$3,750.00		\$0.00	\$3,750.00	Total Load	150	\$3,750.00	\$7,500.00	\$11,250.00
Net by "Zo	ne"	-\$1,250.00		\$0.00	-\$1,250.00			\$1,250.00	\$2,500.00	\$3,750.00
	Т	otal	]							

Load 1B's PJM Bill: \$5,625 for energy.

Load 1B buys Gen 2A Gen 2A gets paid **\$0** Load 1B's Net PJM Bill: \$5,625.

PJM bill does not indicate the amount of congestion paid into PJM system.

Load 1B paid congestion.
Load 2B paid the <u>same</u>
amount of congestion.

Load 1B and 2B paid all congestion.

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\$12,500.00

\$15,000.00

\$2,500.00

\$2,500.00

\$

50.00

50

Zone B

Load 1B

Load 2B

Total Load

Total Gen

Congeston

Shadow Price

Line Limit

**Total Congestion** 

Charges

Credits

CLMP from

Constraint (Move

the reference

bus)



CLMP Charges Proportion of

charges

From

\$50.00

\$50.00

Constraint

\$3,750.00

\$3,750.00

Amount of

Constraint

+CLMP related due to

50% \$

50% \$

**Congestion** paid

1,250.00

1,250.00