PJM Bill Does Not Include Actual Congestion Paid

AFMTF

March 25, 2020

Howard Haas

Monitoring Analytics

The PJM Bill Does Not Include the Amount of Congestion Paid

- **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.**

The PJM Bill Does Not Include the Amount of Congestion Paid

- 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.

The PJM Bill Does Not Include the Amount of Congestion Paid

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

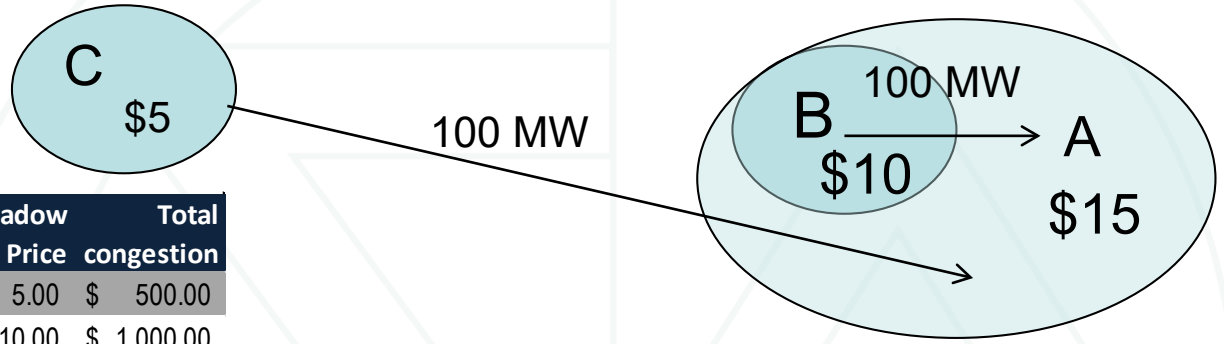
The PJM Bill Does Not Include the Amount of Congestion

- 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.

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

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

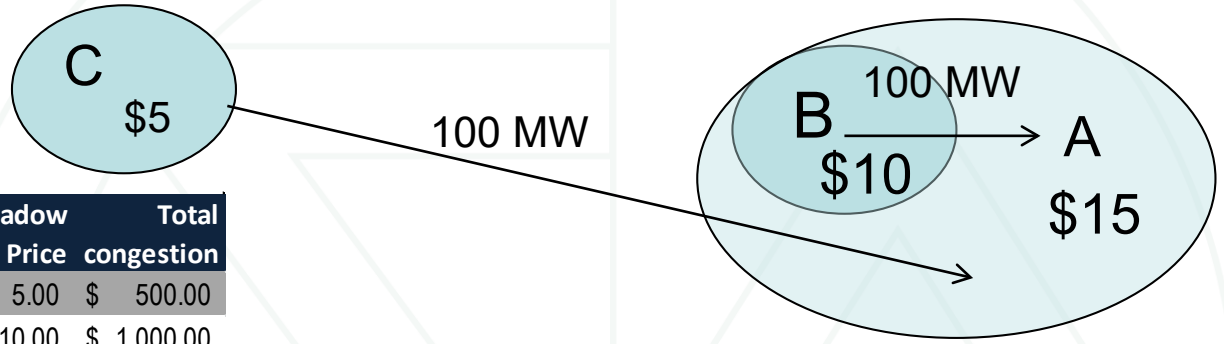
Two Zones, Three Price Points



	Line Limit	Shadow Price	Total congestion
B to A	100	$ 5.00	$ 500.00
C to A	100	$ 10.00	$ 1,000.00
			$ 1,500.00

- 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



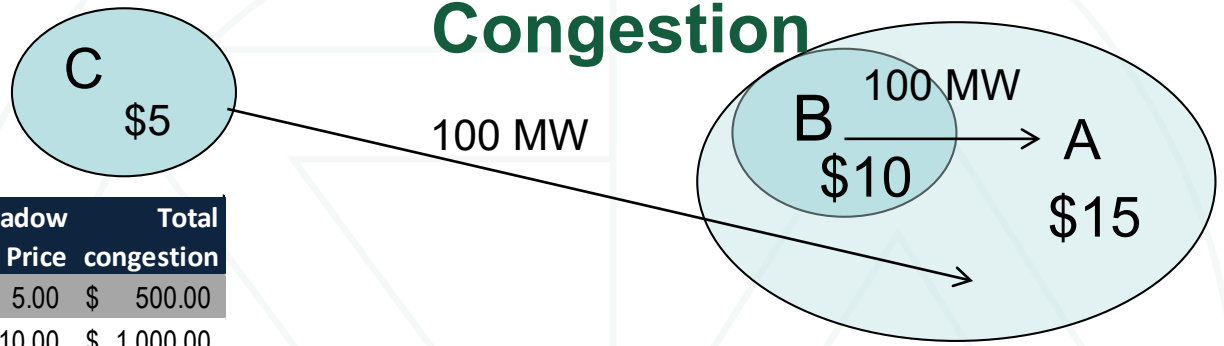
	Line Limit	Shadow Price	Total congestion
B to A	100	$ 5.00	$ 500.00
C to A	100	$ 10.00	$ 1,000.00
			$ 1,500.00

	SMP	CLMP	LMP
A	$ 15.00	$ -	$ 15.00
B	$ 15.00	$ (5.00)	$ 10.00
C	$ 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
- - CLMP indicates LMP lower than SMP

Changing the Reference Bus Does Not Change Congestion



	Line Limit	Shadow Price	Total congestion
B to A	100	$ 5.00	$ 500.00
C to A	100	$ 10.00	$ 1,000.00
			$ 1,500.00

	SMP	CLMP	LMP	Load	Gen
A	$ 15.00	$ -	$ 15.00	250	50
B	$ 15.00	$ (5.00)	$ 10.00	0	100
C	$ 15.00	$ (10.00)	$ 5.00	0	100
				SMP	15

	SMP	CLMP	LMP	Load	Gen
A	$10.00	$5.00	$15.00	250	50
B	$10.00	$0.00	$10.00	250	350
C	$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 Limit	Shadow Price	Total congestion
B to A	100	$ 5.00	$ 500.00
C to A	100	$ 10.00	$ 1,000.00
			$ 1,500.00

	SMP	CLMP	LMP	Load	Gen
A	$ 15.00	$ -	$ 15.00	250	50
B	$ 15.00	$ (5.00)	$ 10.00	0	100
C	$ 15.00	$ (10.00)	$ 5.00	0	100

Bus	Load SMP Charges	CLMP load charges	Total LMP Load Charges	Gen SMP Credits	CLMP Gen Credits	Total LMP Gen Credits
A	$3,750.00	$0.00	$3,750.00	$750.00	$0.00	$750.00
B	$0.00	$0.00	$0.00	$1,500.00	-$500.00	$1,000.00
C	$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

	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 Limit	Shadow Price	Total congestion
B to A	100	$ 5.00	$ 500.00
C to A	100	$ 10.00	$ 1,000.00
			$ 1,500.00

	SMP	CLMP	LMP	Load	Gen
A	$10.00	$5.00	$15.00	250	50
B	$10.00	$0.00	$10.00	250	350
C	$10.00	-$5.00	$5.00	250	350

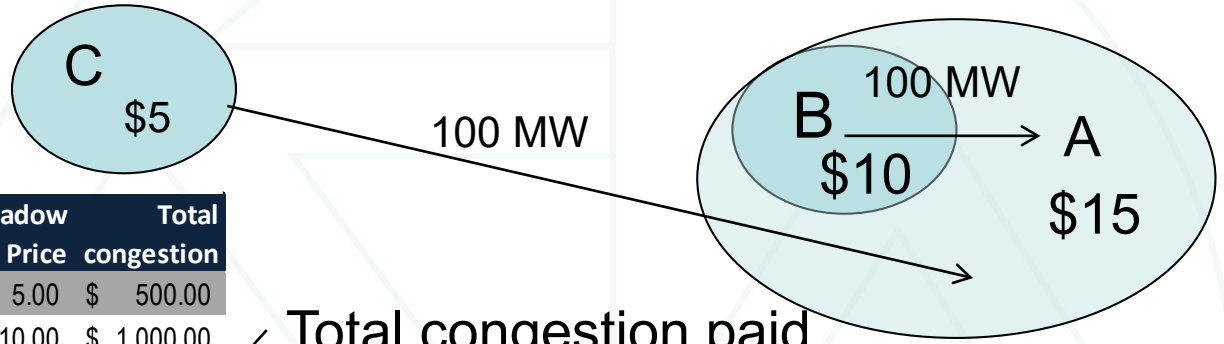
Bus	Load SMP Charges	CLMP load charges	Total LMP Load Charges	Gen SMP Credits	CLMP Gen Credits	Total LMP Gen Credits
A	$2,500.00	$1,250.00	$3,750.00	$500.00	$250.00	$750.00
B	$2,500.00	$0.00	$2,500.00	$3,500.00	$0.00	$3,500.00
C	$2,500.00	-$1,250.00	$1,250.00	$3,500.00	-$1,750.00	$1,750.00
Totals	$7,500.00	$0.00	$7,500.00	$7,500.00	-$1,500.00	$6,000.00

	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

Monitoring Analytics

Simple Model



	Line Limit	Shadow Price	Total congestion
B to A	100	$ 5.00	$ 500.00
C to A	100	$ 10.00	$ 1,000.00
			$ 1,500.00

Total congestion paid

	SMP	CLMP	LMP	Load	Gen
A	$15.00	$0.00	$15.00	250	50
B	$15.00	-$5.00	$10.00	0	100
C	$15.00	-$10.00	$5.00	0	100

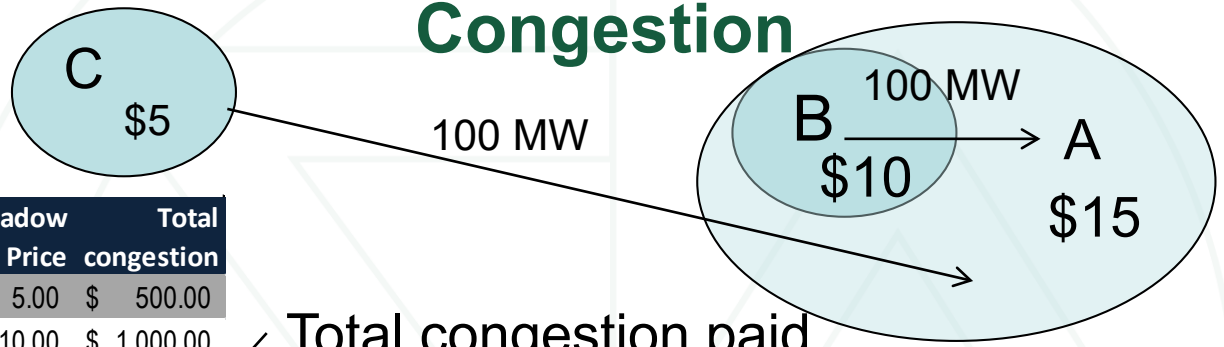
Load at A.
Congestion is the difference between what Load paid and what Gen gets paid.
Load A is the source of congestion.
Load A's Bill only shows congestion charges.
Load A's Bill does not show congestion paid.

Load A's PJM Bill:

Bus	Load SMP Charges	CLMP load charges	Total LMP Load Charges
A	$3,750.00	$0.00	$3,750.00

Charges <> congestion, note CLMP charges = $0

Changing the Reference Bus Does Not Change Congestion



	Line Limit	Shadow Price	Total congestion
B to A	100	$ 5.00	$ 500.00
C to A	100	$ 10.00	$ 1,000.00
			$ 1,500.00

Total congestion paid

	SMP	CLMP	LMP	Load	Gen
A	$10.00	$5.00	$15.00	250	50
B	$10.00	$0.00	$10.00	250	350
C	$10.00	-$5.00	$5.00	250	350

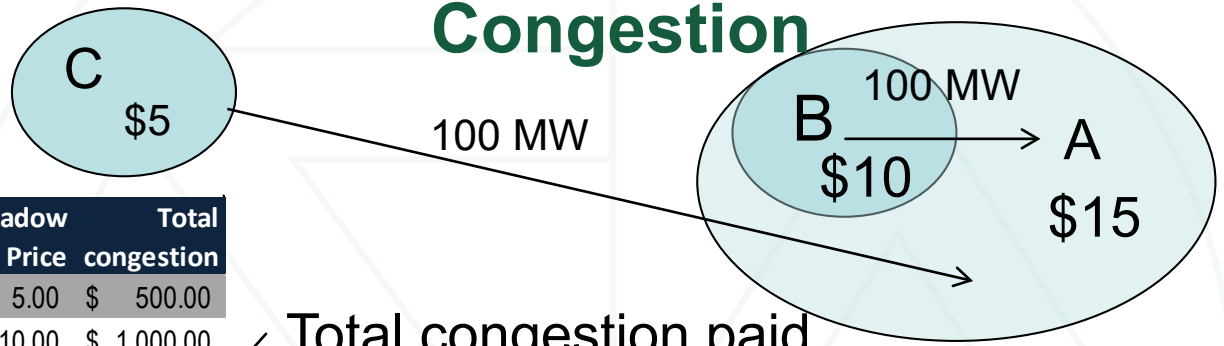
Load at A.
Congestion is the difference between what Load paid and what Gen gets paid.
Load A is the source of congestion.
Load A's Bill only shows congestion charges.
Load A's Bill does not show congestion paid.

Load A's PJM Bill:

Bus	Load SMP Charges	CLMP load charges	Total LMP Load Charges
A	$2,500.00	$1,250.00	$3,750.00

Charges <> congestion, note CLMP charges > $0

Historical Relationships Do Not Determine Congestion



	Line Limit	Shadow Price	Total congestion
B to A	100	$ 5.00	$ 500.00
C to A	100	$ 10.00	$ 1,000.00
			$ 1,500.00

Total congestion paid

	SMP	CLMP	LMP	Load	Gen
A	$15.00	$0.00	$15.00	250	50
B	$15.00	-$5.00	$10.00	0	100
C	$15.00	-$10.00	$5.00	0	100

A has a historical relationship with Generation at A.

How much congestion is paid by load at A?

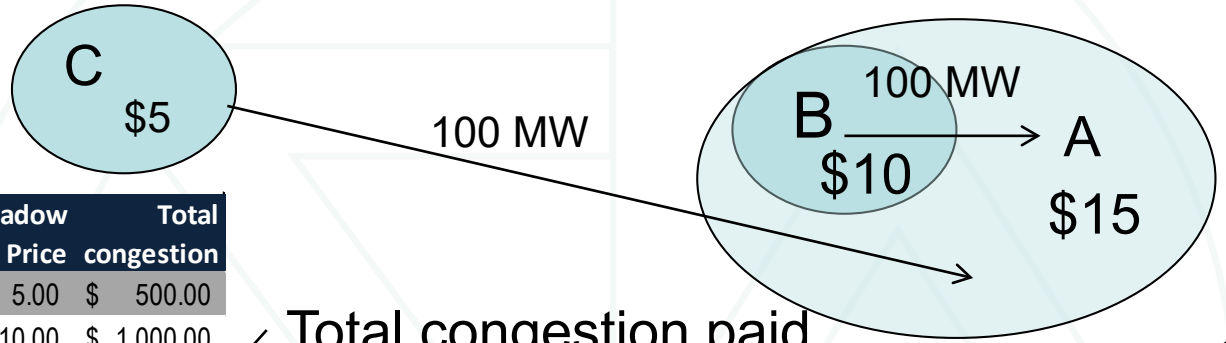
The historical relationship does not affect the amount of congestion paid

Load A's PJM Bill:

Bus	Load SMP Charges	CLMP load charges	Total LMP Load Charges
A	$3,750.00	$0.00	$3,750.00

Charges <> congestion, note CLMP charges = $0

Contracts Affect the Bill, Not Congestion



10 percent self supply from bill.

	Line Limit	Shadow Price	Total congestion
B to A	100	$ 5.00	$ 500.00
C to A	100	$ 10.00	$ 1,000.00
			$ 1,500.00

Total congestion paid

	SMP	CLMP	LMP	Load	Gen
A	$15.00	$0.00	$15.00	250	50
B	$15.00	-$5.00	$10.00	0	100
C	$15.00	-$10.00	$5.00	0	100

Load at A owns Generation at A.
How much congestion is paid by load at A?

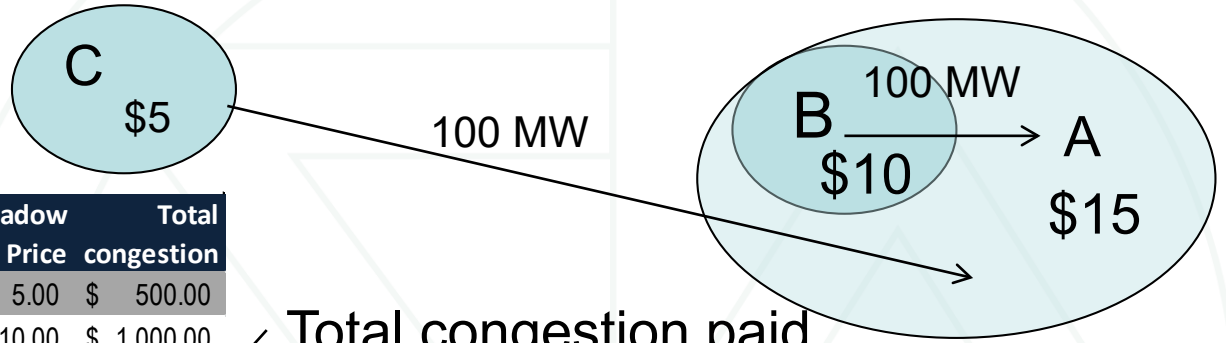
Ownership of generation/self supply does not affect the amount of congestion paid

Load A's PJM Bill:

Bus	Load SMP Charges	CLMP load charges	Total LMP Load Charges	Gen SMP Credits	CLMP Gen Credits	Total LMP Gen Credits	Net Charges
A	$3,750.00	$0.00	$3,750.00	$750.00	$0.00	$750.00	$3,000.00

Ownership affects the bill.

Contracts Affect the Bill, Not Congestion



	Line Limit	Shadow Price	Total congestion
B to A	100	$ 5.00	$ 500.00
C to A	100	$ 10.00	$ 1,000.00
			$ 1,500.00

Total congestion paid

	SMP	CLMP	LMP	Load	Gen
A	$15.00	$0.00	$15.00	250	50
B	$15.00	-$5.00	$10.00	0	100
C	$15.00	-$10.00	$5.00	0	100

Load at A owns Generation at B.
How much congestion is paid by load at A?

Ownership of generation/self supply does not affect the amount of congestion paid by A.

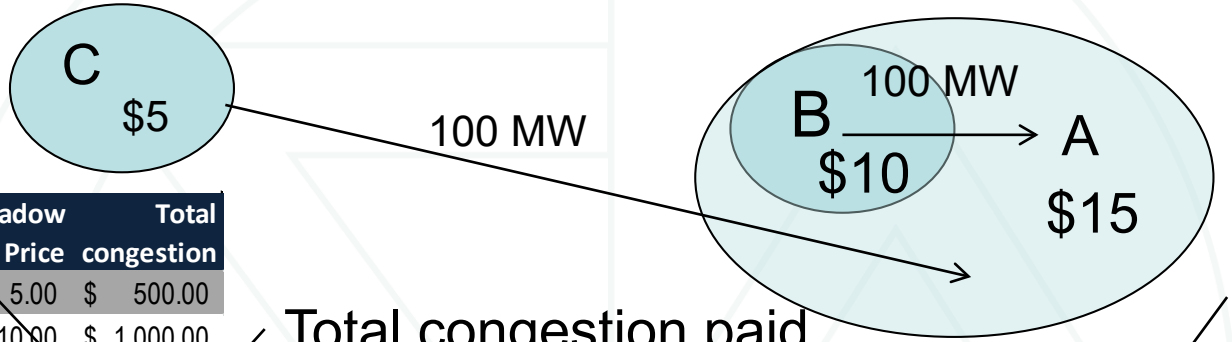
Load A's PJM Bill:

Bus	Load SMP Charges	CLMP load charges	Total LMP Load Charges	Gen SMP Credits	CLMP Gen Credits	Total LMP Gen Credits	Net Charges
A	$3,750.00	$0.00	$3,750.00	$1,500.00	-$500.00	$1,000.00	$2,750.00

Ownership affects the bill.

Contracts Affect the Bill, Not Congestion

More generation, more load, same congestion.



100+ percent self supply from bill (supplying spot too), not from actual network use.

	Line Limit	Shadow Price	Total congestion
B to A	100	$ 5.00	$ 500.00
C to A	100	$ 10.00	$ 1,000.00
			$ 1,500.00

Total congestion paid

Load at A owns Generation at B.
How much congestion is paid by load at A?

	SMP	CLMP	LMP	Load	Gen
A	$10.00	$5.00	$15.00	250	50
B	$10.00	$0.00	$10.00	250	350
C	$10.00	-$5.00	$5.00	250	350

Change in bill due to change in output from gen.
No change in congestion paid by A.

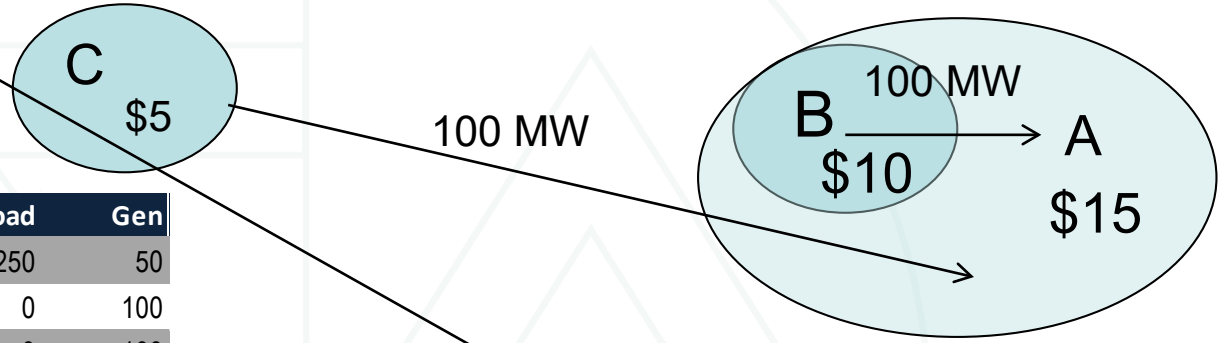
Load A's PJM Bill:

Bus	Load SMP Charges	CLMP load charges	Total LMP Load Charges	Gen SMP Credits	CLMP Gen Credits	Total LMP Gen Credits	Net Charges
A	$2,500.00	$1,250.00	$3,750.00	$3,500.00	$0.00	$3,500.00	$250.00

Ownership affects the bill.

Contracts Affect the Bill, Not Congestion

	Line Limit	Shadow Price	Total congestion
B to A	100	$ 5.00	$ 500.00
C to A	100	$ 10.00	$ 1,000.00
			$ 1,500.00



	SMP	CLMP	LMP	Load	Gen
A	$15.00	$0.00	$15.00	250	50
B	$15.00	-$5.00	$10.00	0	100
C	$15.00	-$10.00	$5.00	0	100

If A granted an FTR from B to A for 100 MW:

Load A's PJM Bill:

Bus	Load SMP Charges	CLMP load charges	Total LMP Load Charges	Gen SMP Credits	CLMP Gen Credits	Total LMP Gen Credits	Net Charges
A	$3,750.00	$0.00	$3,750.00	$1,500.00	-$500.00	$1,000.00	$2,750.00

	FTR B to A
MW	100
CLMP Delta	$5.00
Target Allocation	$500.00

With the FTR A has an offset to congestion between B and A, but not to C to A.

Net CLMP Charges
$500.00

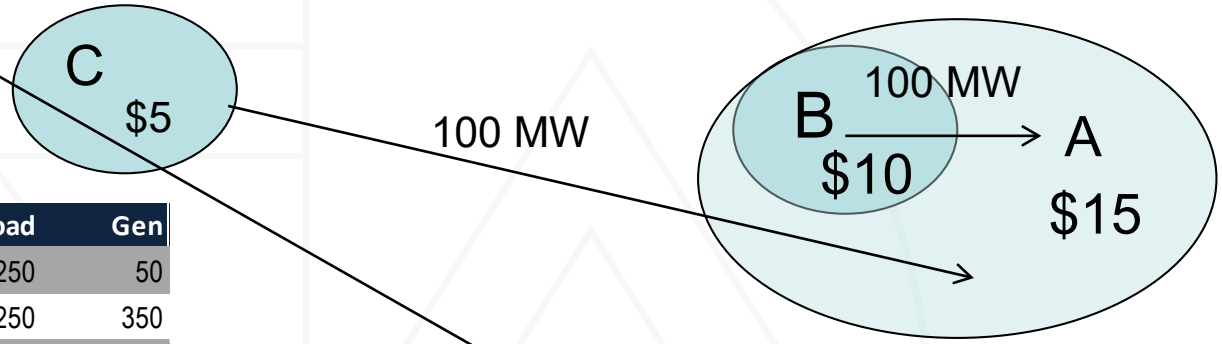
Not congestion, CLMP charges

Contracts Affect the Bill, Not Congestion

	Line Limit	Shadow Price	Total congestion
B to A	100	$ 5.00	$ 500.00
C to A	100	$ 10.00	$ 1,000.00
			$ 1,500.00

Reference bus change

	SMP	CLMP	LMP	Load	Gen
A	$10.00	$5.00	$15.00	250	50
B	$10.00	$0.00	$10.00	250	350
C	$10.00	-$5.00	$5.00	250	350



If A granted an FTR from B to A for 100 MW:

Load A's PJM Bill:

Bus	Load SMP Charges	CLMP load charges	Total LMP Load Charges	Gen SMP Credits	CLMP Gen Credits	Total LMP Gen Credits	Net Charges
A	$2,500.00	$1,250.00	$3,750.00	$3,500.00	$0.00	$3,500.00	$250.00

	FTR B to A
MW	100
CLMP Delta	$5.00
Target Allocation	$500.00

A has an offset to congestion between B and A, but not to C to A

Net CLMP Charges
$1,250.00

Not congestion, CLMP charges

Resource Ownership and Contracts Do Not Affect Actual Congestion

2020

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The PJM Bill Does Not Include the Amount of Congestion Paid

- 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 PJM Bill Does Not Include the Amount of Congestion Paid

- 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 Limit A to B		50				
Zone A		SMP	CLMP	LMP	Zone B		SMP	CLMP	LMP
Price Component		$50.00	-$25.00	$25.00	Price Components		$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 "Zone"		**-$2,500.00**	**$1,250.00**	**-$1,250.00**			**$2,500.00**	**$1,250.00**	**$3,750.00**

	Total
Total Load Charges	$12,500.00
Total Gen Credits	$15,000.00
Congeston	$2,500.00

Shadow Price	$ 50.00
Line Limit	50
Total Congestion	$2,500.00

Zone B	CLMP from Constraint (Move the reference bus)	CLMP Charges From Constraint	Proportion of +CLMP related charges	Amount of Congestion paid due to Constraint
Load 1B	$50.00	$3,750.00	50%	$ 1,250.00
Load 2B	$50.00	$3,750.00	50%	$ 1,250.00

No rights have been assigned to congestion.

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.

<u>Load 1B and 2B paid all congestion.</u>

		Transfer Limit A to B		50				
Zone A		SMP	CLMP	LMP	Zone B		SMP	CLMP	LMP
Price Component		$25.00	$0.00	$25.00	Price Components		$25.00	$50.00	$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	$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		Charges			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 "Zone"		**-$1,250.00**	**$0.00**	**-$1,250.00**			**$1,250.00**	**$2,500.00**	**$3,750.00**

	Total
Total Load Charges	$12,500.00
Total Gen Credits	$15,000.00
Congeston	$2,500.00

Shadow Price	$ 50.00
Line Limit	50
Total Congestion	$2,500.00

Moving the reference bus does not change congestion

Zone B	CLMP from Constraint (Move the reference bus)	CLMP Charges From Constraint	Proportion of +CLMP related charges	Amount of Congestion paid due to Constraint
Load 1B	$50.00	$3,750.00	50%	$ 1,250.00
Load 2B	$50.00	$3,750.00	50%	$ 1,250.00

No rights have been assigned to congestion.

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.

<u>Load 1B and 2B paid all congestion.</u>

		Transfer Limit A to B		50				
Zone A		SMP	CLMP	LMP	Zone B		SMP	CLMP	LMP
Price Component		$50.00	-$25.00	$25.00	Price Components		$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 "Zone"		**-$2,500.00**	**$1,250.00**	**-$1,250.00**			**$2,500.00**	**$1,250.00**	**$3,750.00**

	Total
Total Load Charges	$12,500.00
Total Gen Credits	$15,000.00
Congeston	$2,500.00

Zone B	CLMP from Constraint	CLMP Charges From Constraint	Proportion of +CLMP related charges	Amount of Congestion paid due to Constraint
Load 1A	$0.00	$0.00	0%	$ -
Load 2A	$0.00	$0.00	0%	$ -

Shadow Price	$ 50.00
Line Limit	50
Total Congestion	$2,500.00

No rights have been assigned to congestion.

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.

		Transfer Limit A to B		50				
Zone A		SMP	CLMP	LMP	Zone B		SMP	CLMP	LMP
Price Component		$25.00	$0.00	$25.00	Price Components		$25.00	$50.00	$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	$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		Charges			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 "Zone"		**-$1,250.00**	**$0.00**	**-$1,250.00**			**$1,250.00**	**$2,500.00**	**$3,750.00**

	Total
Total Load Charges	$12,500.00
Total Gen Credits	$15,000.00
Congeston	$2,500.00

Shadow Price	$ 50.00
Line Limit	50
Total Congestion	$2,500.00

Moving the reference bus does not change congestion

Zone B	CLMP from Constraint	CLMP Charges From Constraint	Proportion of +CLMP related charges	Amount of Congestion paid due to Constraint
Load 1A	$0.00	$0.00	0%	$ -
Load 2A	$0.00	$0.00	0%	$ -

No rights have been assigned to congestion.

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.

		Transfer Limit A to B		50				
Zone A		SMP	CLMP	LMP	Zone B		SMP	CLMP	LMP
Price Component		$25.00	$0.00	$25.00	Price Components		$25.00	$50.00	$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	$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		Charges			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 "Zone"		**-$1,250.00**	**$0.00**	**-$1,250.00**			**$1,250.00**	**$2,500.00**	**$3,750.00**

	Total
Total Load Charges	$12,500.00
Total Gen Credits	$15,000.00
Congeston	$2,500.00

Zone B	CLMP from Constraint	CLMP Charges From Constraint	Proportion of +CLMP related charges	Amount of Congestion paid due to Constraint
Load 1A	$0.00	$0.00	0%	$ -
Load 2A	$0.00	$0.00	0%	$ -

Shadow Price	$ 50.00
Line Limit	50
Total Congestion	$2,500.00

No rights have been assigned to congestion.

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.

		Transfer Limit A to B		50				
Zone A		SMP	CLMP	LMP	Zone B		SMP	CLMP	LMP
Price Component		$25.00	$0.00	$25.00	Price Components		$25.00	$50.00	$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	$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		Charges			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 "Zone"		**-$1,250.00**	**$0.00**	**-$1,250.00**			**$1,250.00**	**$2,500.00**	**$3,750.00**

	Total
Total Load Charges	$12,500.00
Total Gen Credits	$15,000.00
Congeston	$2,500.00

Zone B	CLMP from Constraint (Move the reference bus)	CLMP Charges From Constraint	Proportion of +CLMP related charges	Amount of Congestion paid due to Constraint
Load 1B	$50.00	$3,750.00	50%	$ 1,250.00
Load 2B	$50.00	$3,750.00	50%	$ 1,250.00

Shadow Price	$ 50.00
Line Limit	50
Total Congestion	$2,500.00

No rights have been assigned to congestion.

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 the same amount of congestion.

Load 1B and 2B paid all congestion.

		Transfer Limit A to B		50				
Zone A		SMP	CLMP	LMP	Zone B		SMP	CLMP	LMP
Price Component		$25.00	$0.00	$25.00	Price Components		$25.00	$50.00	$75.00
Gen		Credits			Gen		Credits		
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		Charges			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 "Zone"		**-$1,250.00**	**$0.00**	**-$1,250.00**			**$1,250.00**	**$2,500.00**	**$3,750.00**

	Total
Total Load Charges	$12,500.00
Total Gen Credits	$15,000.00
Congeston	$2,500.00

Zone B	CLMP from Constraint (Move the reference bus)	CLMP Charges From Constraint	Proportion of +CLMP related charges	Amount of Congestion paid due to Constraint
Load 1B	$50.00	$3,750.00	50%	$ 1,250.00
Load 2B	$50.00	$3,750.00	50%	$ 1,250.00

Shadow Price	$ 50.00
Line Limit	50
Total Congestion	$2,500.00

No rights have been assigned to congestion.

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 same amount of congestion.

Load 1B and 2B paid all congestion.