PJM Bill Does Not Include Actual Congestion Paid

AFMTF March 25, 2020 **Howard Haas**



- 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 | | 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.

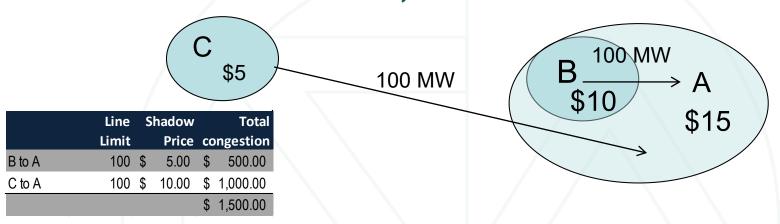
 Self supply through resource ownership or contract will affect the PJM bill but not the congestion paid.

- 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) |

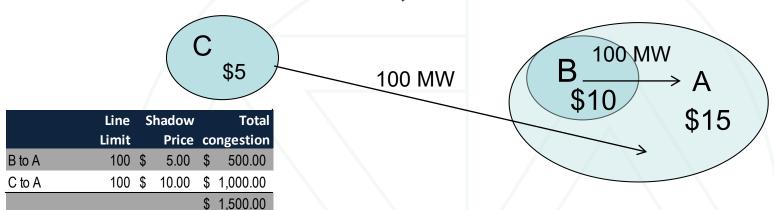
- How much congestion did Customer A pay?
 - Cannot tell from the PJM bill.

Two Zones, Three Price Points



- 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



- SMP
 CLMP
 LMP

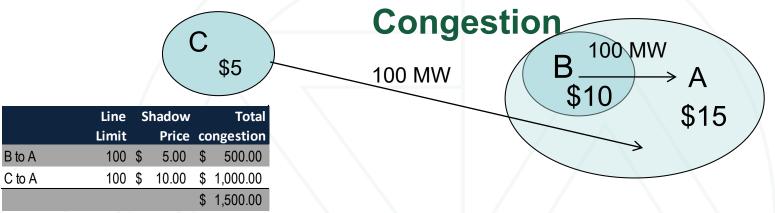
 A
 \$ 15.00
 \$ 15.00

 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



| | | | | _ | |
|---|-------------|---------------|-------------|------|-----|
| | SMP | CLMP | LMP | Load | Gen |
| Α | \$ 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 |
|---|---------|---------|---------|------|-----|
| Α | \$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 | CC | ngestion |
| 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 |
| Α | \$ 15.00 | \$ - | \$ 15.00 | 250 | 50 | Α | \$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 |

| | | Total System |
|--------------------|--------------|--------------------|
| | Total System | Surplus (Charges - |
| | Congestion | 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 | e Shadow | | | Total |
|--------|-------|----------|-------|----|----------|
| | Limit | | Price | CO | ngestion |
| B to A | 100 | \$ | 5.00 | \$ | 500.00 |
| C to A | 100 | \$ | 10.00 | \$ | 1,000.00 |
| | | | | \$ | 1,500.00 |

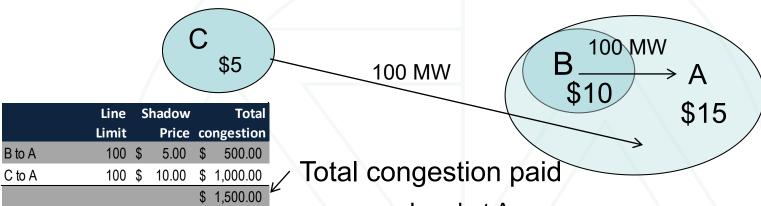
| | | | | | | | | | Total LMP | | | |
|---|---------|---------|---------|------|-----|--------|------------|------------------|------------|------------|-----------------|--------------------|
| | / | | | | | | Load SMP | CLMP load | Load | Gen SMP | CLMP Gen | Total LMP |
| | SMP | CLMP | LMP | Load | Gen | Bus | Charges | charges | Charges | Credits | Credits | Gen Credits |
| Α | \$10.00 | \$5.00 | \$15.00 | 250 | 50 | A | \$2,500.00 | \$1,250.00 | \$3,750.00 | \$500.00 | \$250.00 | \$750.00 |
| В | \$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 |
| С | \$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 |

| | Total System | Total System Surplus (Charges - |
|--------------------|--------------|------------------------------------|
| | Congestion | 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



| | SMP | CLMP | LMP | Load | Gen |
|---|---------|----------|---------|------|-----|
| Α | \$15.00 | \$0.00 | \$15.00 | 250 | 50 |
| В | \$15.00 | -\$5.00 | \$10.00 | 0 | 100 |
| С | \$15.00 | -\$10.00 | \$5.00 | 0 | 100 |

Load A's PJM Bill:

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

Load at A.

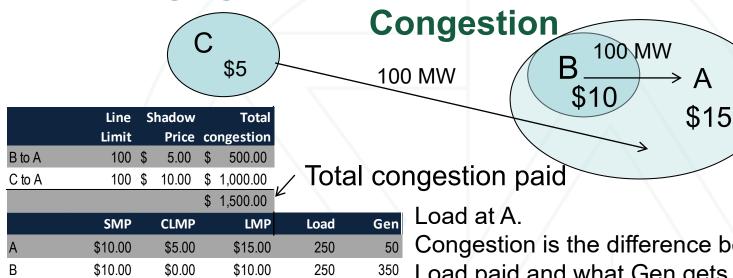
Congestion is the difference between what Load paid and what Gen gets paid.

Load A is the source of congestion.

Load A's Bill only shows congestion charges. Load A's Bill does not show congestion paid.

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

Changing the Reference Bus Does Not Change



250

350

Load A's PJM Bill:

-\$5.00

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

Congestion is the difference between what Load paid and what Gen gets paid.

Load A is the source of congestion.

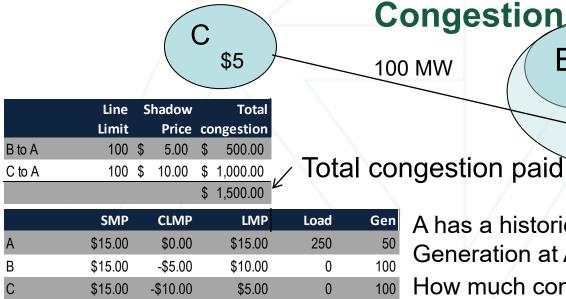
Load A's Bill only shows congestion charges. Load A's Bill does not show congestion paid.

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

\$10.00

\$5.00

Historical Relationships Do Not Determine



A has a historical relationship with Generation at A.

How much congestion is paid by load at A?

100 MW

B

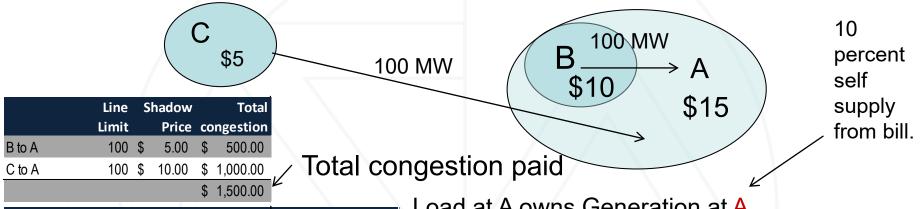
Load A's PJM Bill:

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

The historical relationship does not affect the amount of congestion paid

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

Contracts Affect the Bill, Not Congestion



Gen **SMP CLMP LMP** Load \$15.00 \$0.00 \$15.00 250 100 \$15.00 -\$5.00 \$10.00 0 \$15.00 -\$10.00 \$5.00 100 Load at A owns Generation at A. How much congestion is paid by load at A?

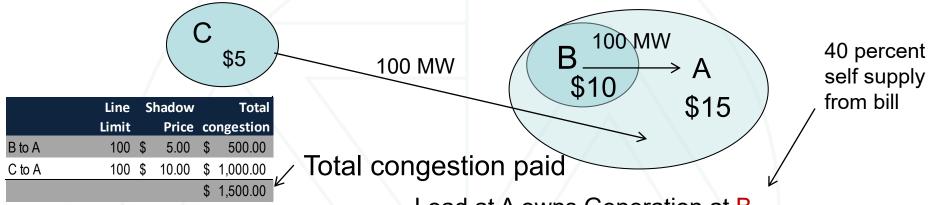
Ownership of generation/self supply does not affect the amount of congestion paid

Load A's PJM Bill:

| | Load SMP | CLMP load | Total LMP Load | | CLMP Gen | Total LMP | |
|-----|------------|-----------|-------------------|----------|----------|-------------|-------------|
| Bus | Charges | charges | Charges | Credits | Credits | Gen Credits | Net Charges |
| Α | \$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



| | SMP | CLMP | LMP | Load | Gen |
|---|---------|----------|---------|------|-----|
| Α | \$15.00 | \$0.00 | \$15.00 | 250 | 50 |
| В | \$15.00 | -\$5.00 | \$10.00 | 0 | 100 |
| С | \$15.00 | -\$10.00 | \$5.00 | 0 | 100 |

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

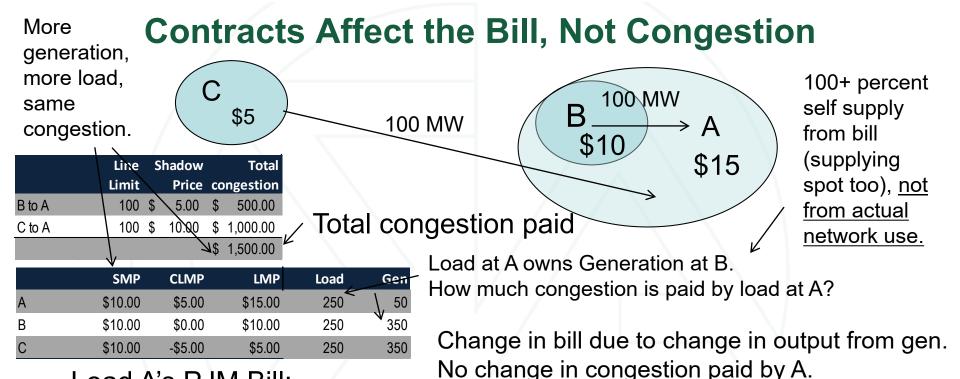
Ownership of generation/self supply does not affect the amount of congestion paid by A.

Load A's PJM Bill:

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

Ownership affects the bill.





Load A's PJM Bill:

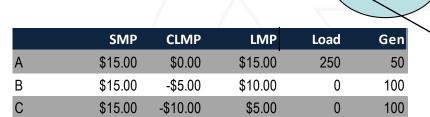
| | | | Total LMP | | | | | |
|-----|------------|------------|------------|------------|----------|--------------------|-------------|----|
| | Load SMP | CLMP load | Load | Gen SMP | CLMP Gen | Total LMP | | |
| Bus | Charges | charges | Charges | Credits | Credits | Gen Credits | Net Charges | ı/ |
| Α | \$2,500.00 | \$1,250.00 | \$3,750.00 | \$3,500.00 | \$0.00 | \$3,500.00 | \$250.00 | |

Ownership affects the bill.





100 MW



500.00

\$ 1,000.00

\$ 1,500.00

Shadow

5.00

10.00

Limit

B to A

C to A

100 \$

100 \$

Load A's PJM Bill:

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

100 MW

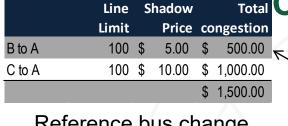
| | | | Total LMP | | | | | | | F | TR B to A |
|-----|------------|-----------|------------|------------|-----------|-------------|-------------|--------|------|---|-----------|
| | Load SMP | CLMP load | Load | Gen SMP | CLMP Gen | Total LMP | | MW | | | 100 |
| Bus | Charges | charges | Charges | Credits | Credits | Gen Credits | Net Charges | CLMP D | elta | | \$5.00 |
| Α | \$3,750.00 | \$0.00 | \$3,750.00 | \$1,500.00 | -\$500.00 | \$1,000.00 | | | | | \$500.00 |

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

\$5

Not congestion, CLMP charges **Net CLMP Charges** \$500.00 Monitoring Analytics 17 www.monitoringanalytics.com

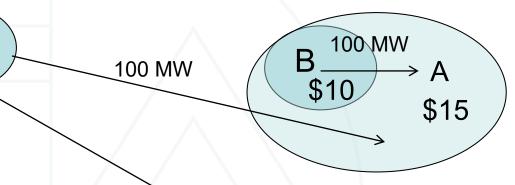
Total Contracts Affect the Bill, Not Congestion



Reference bus change

| | SMP | CLMP | LMP | Load | Gen |
|---|---------|---------|---------|------|-----|
| Α | \$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 |
| | | | | | |

Load A's PJM Bill:



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

| | | | Total LMP | | | | | | F | TR B to A |
|-----|------------|------------|------------|------------|----------|-------------|--------------------|--------------|---|-----------|
| | Load SMP | CLMP load | Load | Gen SMP | CLMP Gen | Total LMP | | MW | | 100 |
| Bus | Charges | charges | Charges | Credits | Credits | Gen Credits | Net Charges | CLMP Delta | | \$5.00 |
| A | \$2,500.00 | \$1,250.00 | \$3,750.00 | \$3,500.00 | \$0.00 | \$3,500.00 | | Target Alloc | | \$500.00 |

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

\$5

Net CLMP Charges \$1,250,00

Not congestion, CLMP charges

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Resource Ownership and Contracts Do Not Affect Actual Congestion

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- 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.

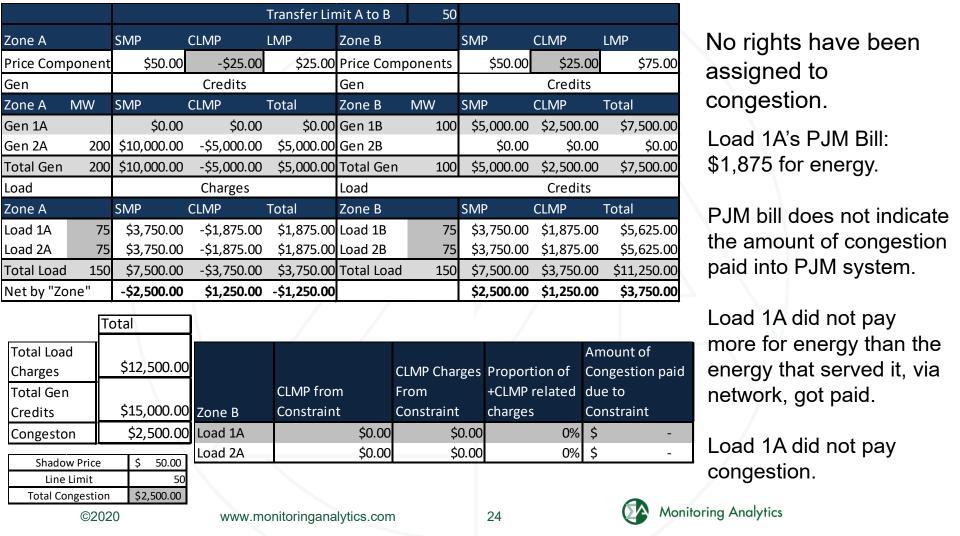
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- The examples show that ownership of generation resources at either bus will change an LSE's PJM bill but will not change the amount of congestion paid by that LSE.
- Self supply affects the PJM bill but does not affect the congestion paid by an LSE.
- 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.

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| | | | | Transfer Lir | nit A to B | 50 | | | | | | |
|-------------------|----------|-------------|-------------|---------------------------|------------|-----------|-------------------------|-------|-----------|-----------------|--------------|--------------------------------------|
| Zone A | | SMP | CLMP | LMP | Zone B | | SMP | (| CLMP | LN | ИP | No rights have been |
| Price Comp | ponent | \$50.00 | -\$25.00 | \$25.00 | Price Com | nponents | \$50 | 0.00 | \$25.0 | 00 | \$75.00 | assigned to congestion. |
| Gen | | | Credits | | Gen | | | | Credits | S | | assigned to songestion. |
| Zone A | MW | SMP | CLMP | Total | Zone B | MW | SMP | (| CLMP | To | otal | Load 1B's PJM Bill: |
| Gen 1A | | \$0.00 | \$0.00 | \$0.00 | Gen 1B | 100 | \$5,000 | 0.00 | \$2,500.0 | 00 | \$7,500.00 | \$5,625 for energy. |
| Gen 2A | 200 | \$10,000.00 | -\$5,000.00 | \$5,000.00 | Gen 2B | | \$(| 0.00 | \$0.0 | 00 | \$0.00 | φο,σ <u>σο</u> του συτου θ χυ |
| Total Gen | 200 | \$10,000.00 | -\$5,000.00 | \$5,000.00 | Total Gen | 100 | \$5,00 | 0.00 | \$2,500.0 | 00 | \$7,500.00 | D IM hill do a constitution to |
| Load | | | Charges | | Load | | | | Credits | S | | PJM bill does not indicate |
| Zone A | | SMP | CLMP | Total | Zone B | | SMP | (| CLMP | To | otal | the amount of congestion |
| Load 1A | 75 | \$3,750.00 | -\$1,875.00 | \$1,875.00 | Load 1B | 75 | \$3,75 | 0.00 | \$1,875.0 | 00 | \$5,625.00 | paid into PJM system. |
| Load 2A | 75 | \$3,750.00 | -\$1,875.00 | \$1,875.00 | Load 2B | 75 | \$3,75 | 0.00 | \$1,875.0 | 00 | \$5,625.00 | , |
| Total Load | 150 | \$7,500.00 | -\$3,750.00 | \$3,750.00 | Total Load | d 150 | \$7,50 | 0.00 | \$3,750.0 | 00 : | \$11,250.00 | Land 1D maid many fam |
| Net by "Zo | ne" | -\$2,500.00 | \$1,250.00 | -\$1,250.00 | | | \$2,50 | 0.00 | \$1,250.0 | 00 | \$3,750.00 | Load 1B paid more for |
| | _ | | 1 | | | | | | | | | energy than the |
| | To | otal | 1 | | | | | | | | | generation that served |
| Total Load | d | . \ | | CLMP fro | m | | | | | Amo | ount of | 1B via network was paid. |
| Charges | | \$12,500.00 | | Constrair | nt (Move | CLMP Cha | rges Pr | oport | ion of | Con | gestion paid | 16 via network was paid. |
| Total Gen | 1 | | | the refer | ence | From | +C | CLMP | related | due | to | |
| Credits | | \$15,000.00 | Zone B | bus) | | Constrain | t ch | arges | | Cons | straint | Load 1B paid congestion. |
| Congesto | n | \$2,500.00 | Load 1B | | \$50.00 | \$3,75 | 50.00 | | 50% | \$ | 1,250.00 | |
| Shadov | w Price | \$ 50.00 | Load 2B | | \$50.00 | \$3,75 | 50.00 | | 50% | \$ | 1,250.00 | Load 1B and 2B paid all |
| | Limit | 50 | | | | | | | | | | congestion. |
| Total Co | ngestion | \$2,500.00 | | | | | | | | | AAnn | / |
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| | | | | Transfer Lir | nit A to B | 50 | | | | | |
|------------|-----------|-------------|---------|-----------------------------|------------|------------|------------|----------|-------------------------|--|--|
| Zone A | | SMP | CLMP | LMP | Zone B | | SMP | CLMP | LMP | No rights have been | |
| Price Com | ponent | \$25.00 | \$0.00 | \$25.00 | Price Con | nponents | \$25.00 | \$50. | 00 \$75. | | |
| Gen | | | Credits | | Gen | | | Credit | S | | |
| Zone A | MW | SMP | CLMP | Total | Zone B | MW | SMP | CLMP | Total | Load 1B's PJM Bill: | |
| Gen 1A | | \$0.00 | \$0.00 | \$0.00 | Gen 1B | 100 | \$2,500.00 | \$5,000. | 00 \$7,500. | ⁰⁰ \$5,625 for energy. | |
| Gen 2A | 200 | \$5,000.00 | \$0.00 | \$5,000.00 | Gen 2B | | \$0.00 | \$0. | 00 \$0. | | |
| Total Gen | 200 | \$5,000.00 | \$0.00 | \$5,000.00 | Total Gen | 100 | \$2,500.00 | \$5,000. | 00 \$7,500. | DIM bill door not indicate | |
| Load | | | Charges | | Load | | | Credit | S | PJM bill does not indicate | |
| Zone A | | SMP | CLMP | Total | Zone B | | SMP | CLMP | Total | the amount of congestion | |
| Load 1A | 75 | \$1,875.00 | \$0.00 | . , | | 75 | \$1,875.00 | \$3,750. | 00 \$5,625. | ∞ paid into PJM system. | |
| 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 | d 150 | \$3,750.00 | \$7,500. | 00 \$11,250. | 00 Lood 1P poid more for | |
| Net by "Zo | one" | -\$1,250.00 | \$0.00 | -\$1,250.00 | | | \$1,250.00 | \$2,500. | 00 \$3,750. | | |
| | T | otal | Moving | the refe | rence b | us does | not cha | nge co | ngestion | energy than the generation that served | |
| Total Loa | ıd | | | CLMP fro | m | | | | Amount of | 1B via network was paid. | |
| Charges | | \$12,500.00 | | Constrair | t (Move | CLMP Char | ges Propo | rtion of | Congestion | paid | |
| Total Ger | n | | | the refer | ence | From | +CLMP | related | due to | | |
| Credits | | \$15,000.00 | Zone B | bus) | | Constraint | charge | S | Constraint | Load 1B paid congestion. | |
| Congesto | on | \$2,500.00 | Load 1B | | \$50.00 | \$3,75 | 0.00 | 50% | \$ 1,25 | 0.00 | |
| Shado | w Price | \$ 50.00 | Load 2B | | \$50.00 | \$3,75 | 0.00 | 50% | \$ 1,25 | 0.00 Load 1B and 2B paid all | |
| | Limit | 50 | | | | | | | | congestion. | |
| Total Co | ongestion | • | | | | | | | | | |
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| | | | | Transfer Lir | nit A to B | 50 | | | | |
|------------|--------------------------------------|-------------|-----------|----------------------|------------|------------|------------|----------|-------------|----------------------------|
| Zone A | | SMP | CLMP | LMP | Zone B | | SMP | CLMP | LMP | No rights have been |
| Price Com | ponent | \$25.00 | \$0.00 | \$25.00 | Price Con | nponents | \$25.00 | \$50. | 00 \$75 | cool |
| Gen | | | Credits | | Gen | | | Credit | S | assigned to |
| Zone A | MW | SMP | CLMP | Total | Zone B | MW | SMP | CLMP | Total | congestion. |
| Gen 1A | | \$0.00 | \$0.00 | \$0.00 | Gen 1B | 100 | \$2,500.00 | \$5,000. | 00 \$7,500 | 0.00 |
| Gen 2A | 200 | \$5,000.00 | \$0.00 | \$5,000.00 | Gen 2B | | \$0.00 | \$0. | 00 \$0 | Load 1A's PJM Bill: |
| Total Gen | 200 | \$5,000.00 | \$0.00 | \$5,000.00 | Total Gen | n 100 | \$2,500.00 | \$5,000. | 00 \$7,500 | . <u></u> |
| Load | | | Charges | | Load | | | Credit | S | |
| Zone A | | SMP | CLMP | Total | Zone B | | SMP | CLMP | Total | PJM bill does not indicate |
| Load 1A | 75 | \$1,875.00 | \$0.00 | \$1,875.00 | | 75 | \$1,875.00 | . , | | 5.00 |
| Load 2A | 75 | \$1,875.00 | \$0.00 | \$1,875.00 | Load 2B | 75 | \$1,875.00 | \$3,750. | 00 \$5,625 | |
| Total Load | 150 | . , | \$0.00 | \$3,750.00 | Total Load | d 150 | \$3,750.00 | \$7,500. | 00 \$11,250 | paid into PJM system. |
| Net by "Zo | ne" | -\$1,250.00 | \$0.00 | -\$1,250.00 | | | \$1,250.00 | \$2,500. | 00 \$3,750 | 0.00 |
| | ĪŦ | otal | 1 Moving | the refe | rence b | us does | not cha | ange co | ngestion | Load 1A did not pay |
| | | Otal | | | | | | | • | more for energy than the |
| Total Loa | d | \$12,500.00 | | | | | _ | | Amount of | |
| Charges | — | \$12,500.00 | <u>'1</u> | CLA 4D C | | | rges Propo | | Congestion | , |
| Total Ger | ו | ¢1E 000 00 | | CLMP from | | From | | Prelated | | network, got paid. |
| Credits | | \$15,000.00 | | Constrain | | Constraint | <u> </u> | | Constraint | |
| Congesto | n | \$2,500.00 | _ | | \$0.00 | · | 0.00 | 0% | • | Load 1A did not pay |
| Shado | w Price | \$ 50.00 | Load 2A | | \$0.00 | Ş | 0.00 | 0% | \$ | congestion. |
| | Limit | 50 | | | | | | | | congestion. |
| Total Co | Total Congestion \$2,500.00 | | _ | | | | 0.5 | | | Monitoring Analytics |
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| | | Transfer Limit A t | | | nit A to B | 50 | | | | | |
|-----------------|----------------------------|--------------------|-----------------------------|-------------|--|------------|---------------|-------------------------|----------------|----------------------------|--|
| Zone A | | SMP | CLMP | LMP | Zone B | | SMP | CLMP | LMP | No rights have been | |
| Price Component | | \$25.00 | \$0.00 | \$25.00 | Price Con | nponents | \$25.00 | \$50.0 | 90 \$75.00 | | |
| Gen | | | Credits | | Gen | | | Credits | 5 | assigned to | |
| Zone A | MW | SMP | CLMP | Total | Zone B | MW | SMP | CLMP | Total | congestion. | |
| Gen 1A | | \$0.00 | \$0.00 | \$0.00 | Gen 1B | 100 | \$2,500.00 | \$5,000.0 | 00 \$7,500.00 | | |
| Gen 2A | 200 | \$5,000.00 | \$0.00 | \$5,000.00 | Gen 2B | | \$0.00 | \$0.0 | 00 \$0.00 | Load 1A's PJM Bill: | |
| Total Gen | 200 | \$5,000.00 | \$0.00 | \$5,000.00 | Total Gen | 100 | \$2,500.00 | \$5,000.0 | 00 \$7,500.00 | \$1,875 for energy. | |
| Load | | Charges | | | Load | | | Credits | | \ | |
| Zone A | | SMP | CLMP | Total | Zone B | | SMP | CLMP | Total | Load 1A buys Gen 2A. | |
| Load 1A | 75 | \$1,875.00 | \$0.00 | \$1,875.00 | Load 1B | 75 | \$1,875.00 | \$3,750.0 | 00 \$5,625.00 | , | |
| Load 2A | 75 | \$1,875.00 | \$0.00 | \$1,875.00 | Load 2B | 75 | \$1,875.00 | \$3,750.0 | 00 \$5,625.00 | Gen 2A is paid \$5,000 | |
| Total Load | 150 | \$3,750.00 | \$0.00 | \$3,750.00 | Total Load | d 150 | \$3,750.00 | \$7,500.0 | 00 \$11,250.00 | | |
| Net by "Zo | ne" | -\$1,250.00 | \$0.00 | -\$1,250.00 | | | \$1,250.00 | \$2,500.0 | 00 \$3,750.00 | PJM bill does not indicate | |
| F | | otal | | | | | | | | the amount of congestion | |
| | <u>T</u> | | 1 | | | | | | | S | |
| Total Load | d | 4 | | | | | | , | Amount of | paid into PJM system. | |
| Charges | | \$12,500.00 | | | CLMP Charges Proportion of Congestion paid | | Congestion pa | | | | |
| Total Gen | | | | CLMP from | m | From | +CLMF | related | due to | Load 1A did not pay | |
| Credits | | \$15,000.00 | Zone B | Constrain | t | Constraint | : charge | es (| Constraint | congestion. | |
| Congeston | | \$2,500.00 | Load 1A | | \$0.00 | \$ | 0.00 | 0% | \$ - | | |
| Shadow Price \$ | | \$ 50.00 | Load 2A | | \$0.00 | \$ | 0.00 | 0% \$ | | Gen 2A was paid LMP for | |
| Line Limit | | 50 | | | | | | | | its output. | |
| Total Co | Total Congestion \$2,500.0 | | | | | | | | | | |
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| | | Transfer Limit A | | | | 50 | | | | | | | |
|--|--------|------------------------------|-----------------------------|-------------------------------------|------------------------|-------------------|--------|-------------------------|------------------|---------------|------------|---|--|
| Zone A | | SMP | CLMP | LMP | Zone B | | SMP | (| CLMP | LIV | 1P | No rights have been | |
| Price Com | ponent | \$25.00 | \$0.00 | \$25.00 | Price Com | ponents | \$2 | 25.00 | \$50.0 | 00 | \$75.00 | assigned to congestion. | |
| Gen | | | Credits | | Gen | | | | Credit | S | | accigned to congection. | |
| Zone A | MW | SMP | CLMP | Total | Zone B | MW | SMP | (| CLMP | To | tal | Load 1B's PJM Bill: | |
| Gen 1A | | \$0.00 | \$0.00 | \$0.00 | Gen 1B | 100 | \$2,50 | 00.00 | \$5,000.0 | 00 | \$7,500.00 | \$5,625 for energy. | |
| Gen 2A | 200 | \$5,000.00 | \$0.00 | \$5,000.00 | Gen 2B | | \$ | \$0.00 | \$0.0 | 00 | \$0.00 | | |
| Total Gen | 200 | \$5,000.00 | \$0.00 | \$5,000.00 | Total Gen | 100 | \$2,50 | 00.00 | \$5,000.0 | 00 | \$7,500.00 | Load 1B buys Gen 2A | |
| Load | Load | | Charges | | Load | | | Credits | | | | Gen 2A gets paid \$5,000 | |
| Zone A | | SMP | CLMP | Total | Zone B | | SMP | (| CLMP | To | tal | Load 1B's Net PJM Bill: | |
| Load 1A | 75 | \$1,875.00 | \$0.00 | \$1,875.00 | Load 1B | 75 | \$1,87 | 75.00 | \$3,750.0 | 00 | \$5,625.00 | \$625. | |
| Load 2A | 75 | \$1,875.00 | \$0.00 | \$1,875.00 | Load 2B | 75 | \$1,87 | 75.00 | \$3,750.0 | 00 | \$5,625.00 | Ψ020. | |
| Total Load | 150 | \$3,750.00 | \$0.00 | \$3,750.00 | Total Load | l 150 | \$3,75 | 50.00 | \$7,500.0 | 00 \$ | 11,250.00 | PJM bill does not indicate the | |
| Net by "Zone" | | -\$1,250.00 | \$0.00 | -\$1,250.00 | | | \$1,25 | 1,250.00 \$2,500.0 | | 00 \$3,750.00 | | amount of congestion paid | |
| To | | otal | | | | | | | into PJM system. | | | | |
| Total Loa Charges Total Ger Credits | | \$12,500.00 \$15,000.00 | | CLMP from Constraint the references | nt (Move (ence F | CLMP Char From | +C | CLMP r | ion of elated | Cong due t | | Load 1B paid congestion. Load 2B paid the same | |
| | | | | bus) | | Constraint | | narges | | | traint | amount of congestion. | |
| Congeston | | \$2,500.00 | - | | \$50.00 | | | | | \$ 1,250.00 | | | |
| Shadow Price Line Limit Total Congestion | | \$ 50.00 50 \$2,500.00 | Load 2B | | \$50.00 \$3,750.0 | | | 50% \$ 1,250.00 | | | 1,250.00 | Load 1B and 2B paid all congestion. | |
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| | | | | Transfer Lir | nit A to B | 50 | | | | | |
|-----------------------|---------|-------------|-----------------------------|--------------|------------|------------|-----------|-------------------------|-----------|---------|---|
| Zone A | | SMP | CLMP | LMP | Zone B | 9 | SMP | CLMP | LMP | | No rights have been |
| Price Comp | onent | \$25.00 | \$0.00 | \$25.00 | Price Con | nponents | \$25.0 | 0 \$50. | 00 \$ | 75.00 | assigned to congestio |
| Gen | | | Credits | | Gen | | | Credit | S | | |
| Zone A | MW | SMP | CLMP | Total | Zone B | MW S | SMP | CLMP | Total | | Load 1B's PJM Bill: |
| Gen 1A | 200 | \$5,000.00 | \$0.00 | \$5,000.00 | Gen 1B | 100 | \$2,500.0 | 0 \$5,000. | 00 \$7,5 | 00.00 | \$5,625 for energy. |
| Gen 2A | 0 | \$0.00 | \$0.00 | \$0.00 | Gen 2B | | \$0.0 | 0 \$0. | 00 | \$0.00 | |
| Total Gen | 200 | \$5,000.00 | \$0.00 | \$5,000.00 | Total Gen | 100 | \$2,500.0 | 0 \$5,000. | 00 \$7,5 | 00.00 | Load 1B buys Gen 2A |
| Load | | | Charges | | Load | | | Credit | S | | Gen 2A gets paid \$0 |
| Zone A | | SMP | CLMP | Total | Zone B | ! | SMP | CLMP | Total | | Load 1B's Net PJM Bill: |
| Load 1A | 75 | \$1,875.00 | \$0.00 | \$1,875.00 | Load 1B | 75 | \$1,875.0 | 0 \$3,750. | 00 \$5,6 | 25.00 | \$5,625. |
| Load 2A | 75 | \$1,875.00 | \$0.00 | \$1,875.00 | Load 2B | 75 | \$1,875.0 | 0 \$3,750. | 00 \$5,6 | 25.00 | Ψ5,625. |
| Total Load | 150 | \$3,750.00 | \$0.00 | \$3,750.00 | Total Load | d 150 | \$3,750.0 | 0 \$7,500. | 00 \$11,2 | 50.00 | PJM bill does not indicate |
| Net by "Zo | ne" | -\$1,250.00 | \$0.00 | -\$1,250.00 | | | \$1,250.0 | 0 \$2,500. | 00 \$3,7 | 50.00 | |
| | To | otal | 1 | | | | | | | | amount of congestion painto PJM system. |
| Total Load | d | | | CLMP fro | m | | | | Amount o | of | |
| Charges | | \$12,500.00 | | Constrair | | CLMP Char | ges Prop | ortion of | Congestio | | Load 1B paid congestion |
| Total Gen | ı | | | the refer | | From | · . | 1P related | | | Load 2B paid the <u>same</u> |
| Credits | | \$15,000.00 | Zone B | bus) | | Constraint | char | ges | Constrain | nt | amount of congestion. |
| Congesto | n | \$2,500.00 | Load 1B | | \$50.00 | \$3,750 | 0.00 | 50% | \$ 1 | ,250.00 | |
| Shadov | w Price | \$ 50.00 | Load 2B | | \$50.00 | \$3,750 | 0.00 | 50% | \$ 1 | ,250.00 | Load 1B and 2B paid all |
| Line Limit | | 50 | | | | | | | | | congestion. |
| Total Congestion ©202 | | | www.monitoringanalytics.com | | | | 28 | 28 Monitoring Analytics | | | |