Basic Congestion Concepts

2019

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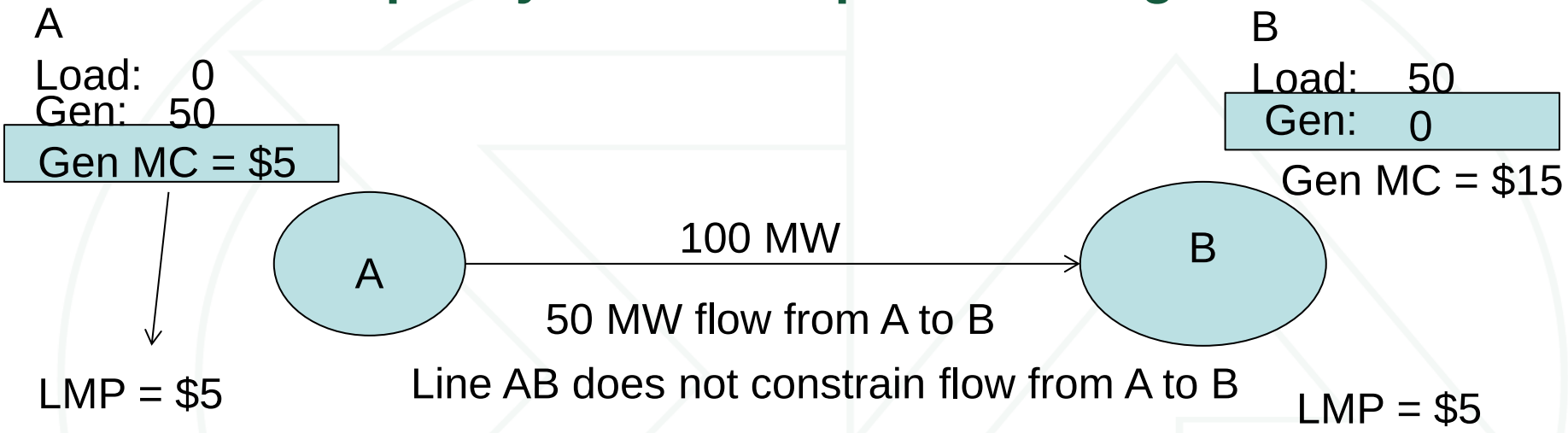
Monitoring Analytics

Congestion

- **Congestion = The difference between total charges to load and total payments to generation caused by binding transmission constraints.**
  - **Binding transmission constraints cause price differences on the system**
  - **With binding constraints, load pays more for energy than generation gets paid for energy**
  - **Generation upstream of generation is paid lower prices than generation downstream of congestion**
  - **Load downstream of congestion pays the higher (upstream price) for all of its energy**
  - **The difference in payments from load to generators is congestion**

Simple System Example: No Congestion



What are the LMPs at A and B?

	A	Constraint	B
LMP	$5	---->	$5

	Zone A	Zone B
Load MW	0	50
Marginal Price of Power	$5.00	$5.00

(LMP x MW)	Zone A	Zone B	Total
Load Charges	$0.00	$250.00	$250.00
Generation Credits	$250.00	$0.00	$250.00
Total Credits/Charges	($250.00)	$250.00	$0

Congestion= Load Charges – Gen Credits

Congestion = The difference between total charges to load and total payments to generation caused by binding transmission constraints.

Simple System Example: Congestion

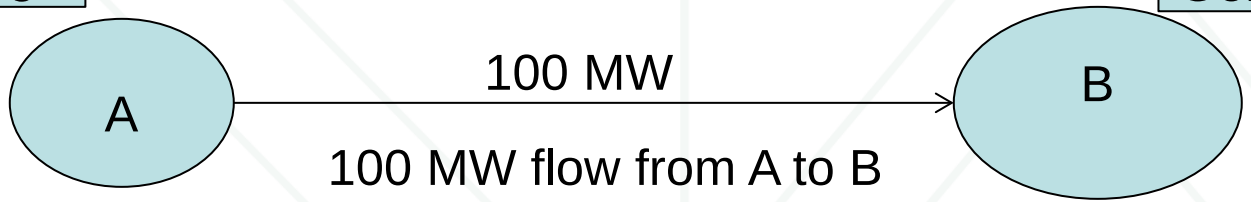
A
Load: 0
Gen: 100

Gen MC = $5

What are the LMPs at A and B?

B
Load: 150
Gen: 50

Gen MC = $15



100 MW flow from A to B

LMP = $5

Line AB constrains the flow from A to B
Gen at B is needed to meet some of load.

LMP = $15

	A	Constraint	B
LMP	$5	----->	$15

	Zone A	Zone B
Load MW	0	150
Marginal Price of Power	$5.00	$15.00

(LMP x MW)	Zone A	Zone B	Total
Load Charges	$0.00	$2,250.00	$2,250.00
Generation Credits	$500.00	$750.00	$1,250.00
Total Credits/Charges	($500.00)	$1,500.00	$1,000

Congestion= Load Charges – Gen Credits

Congestion = The difference between total charges to load and total payments to generation caused by binding transmission constraints.

Path Based FTR vs. Direct Allocation of Congestion FTR

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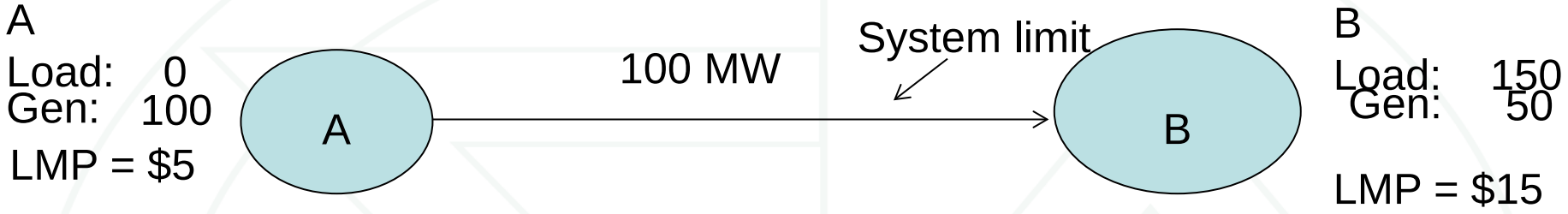
Congestion Allocation: FTR or Direct

- **Congestion = The difference between total charges to load and total payments to generation caused by binding transmission constraints.**
- **Congestion belongs to load**
- **If congestion is returned to load, load gets credit for the access to upstream generation made available by transmission.**
- **If congestion is returned to the load that paid it, the average cost of power realized by the load will equal the actual average cost of energy that served that load.**
- **Load has the rights to congestion but can sell that right**
  - **In the current system load can claim or passively sell path based, modeled path based rights to congestion**
  - **Under proposed construct, load can keep or sell actual congestion (network based)**

FTR vs Direction Allocation



Max FTR MW = System Limit = 100 MW

- PJM can make 100 MW available on line AB as an FTR
- Load can self schedule and claim the FTR or passively sell and get the auction revenue from the sale (ARR)
  - Maximum potential value of FTR from A to B = (FTR MW) x (Price difference between B and A)

FTR Target Allocation = (LMP Sink – LMP Source) x FTR MW

If FTR MW = 100 MW, then FTR Target Allocation = $1,000

Congestion assigned to FTR = $1,000

If Congestion is assigned to load directly, Congestion assigned = $1,000

FTR vs. Direction Allocation

- **Load has the rights to congestion but can sell that right**
  - **In the current system load can claim or passively sell path based, modeled path based rights to congestion**
    - **In this example FTR claims $1,000 in congestion**
    - **In a simple one line system, perfect alignment in model and actual system capability (and single settlement market) results in FTR being the right to actual congestion**
    - **Simple one line system eliminates cross subsidy and leakage issue than cause a misalignment of target allocations and actual congestion**
  - **Under proposed construct, load can keep or sell actual congestion (network based)**
    - **In this example, the FTR, defined as the direct allocation of actual congestion, claims $1,000 in congestion**
    - **Direct allocation FTR always results in the allocation of actual congestion based on actual network.**

Allocation of congestion: Affect on Average Cost of Load

	A	Constraint	B
LMP	$5	---->	$15
SMP	$5		$5
CLMP	$0		$10
	Reference Bus	100	
Load MW	0		150
Gen MW	100		50

CLMP x MW	Zone Based A	Zone Based B	Total Congestion
Load Charges	$0	$1,500	$1,500
Gen Credits	$0	$500	$500
Total Charges	$0	$1,000	$1,000

	Zone A	Zone B
Load MW	0	150
Marginal Price of Power	$5.00	$15.00
Total Load Charges	$0.00	$2,250.00
Average Cost of Power	$5.00	$15.00
Congestion Allocation	$0.00	$1,000.00
Net Load Charges	$0.00	$1,250.00
Marginal Price of Power	$5.00	$15.00
Average Cost of Power	NA	$8.33

Marginal Price does not change

With correct congestion allocation, average cost of power reflects actual average cost for serving zone

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