

# Locational Based Marginal Pricing

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E- Learning Module



# Locational Based Marginal Pricing

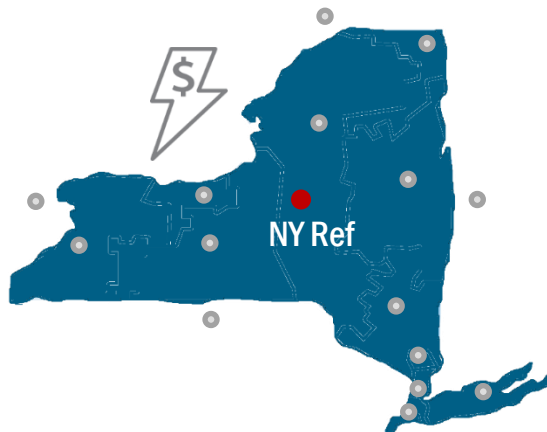
## Module Objectives:

- Explain the Basics Behind LBMP
- Complete Simple LBMP Examples
- Identify the Impacts of Congestion

# LBMP – The Basics

- LBMP is

Cost to supply the Next MW to Load at a Specific Location in the grid

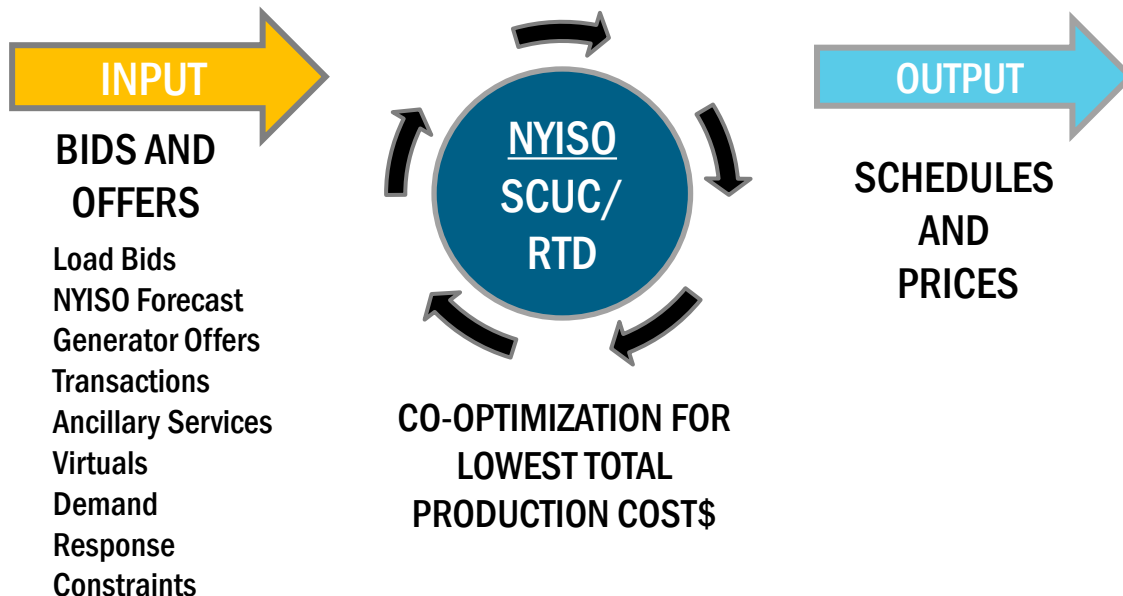


# LBMP – The Basics

- LBMP is established for the Day Ahead Market and the Real Time Market

<b>Day Ahead Market</b>	<b>Real Time Market</b>
<b>Software: Security Constrained Unit Commitment (SCUC)</b>	<b>Real Time Dispatch (RTD)</b>
<b>Hourly Prices</b>	<b>5 Minute Interval Prices</b>

# LBMP: Co-Optimized Based on Bids and Offers

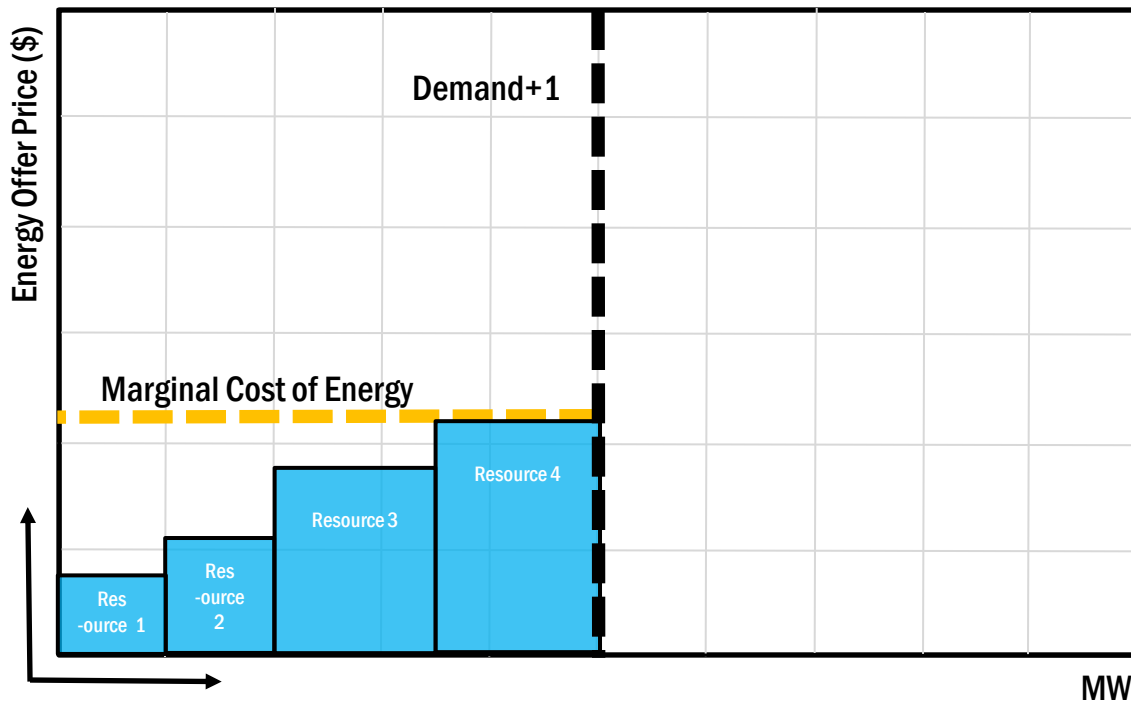


# LBMP – The Basics

- **LBMP is made up of three components:**
  - **Marginal Energy Price**
    - **Basic Component of LBMP, calculated at Marcy**
  - **Marginal Loss Price**
    - **Captures Losses along path to Load**
      - **Transmission Losses**
  - **Marginal Congestion Price**
    - **Costlier units Dispatched to avoid exceeding Transmission Limits**

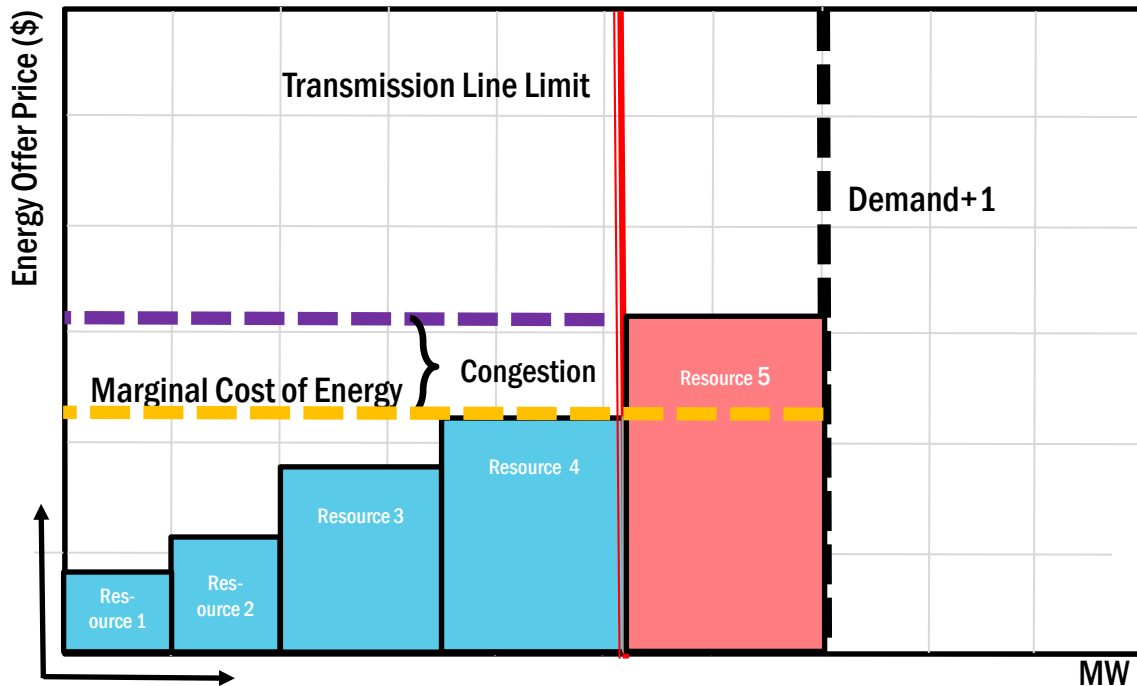
$$\text{LBMP} = \text{Energy} + \text{Loss} - \text{Congestion}$$

# Determining the Marginal Energy Price



MW

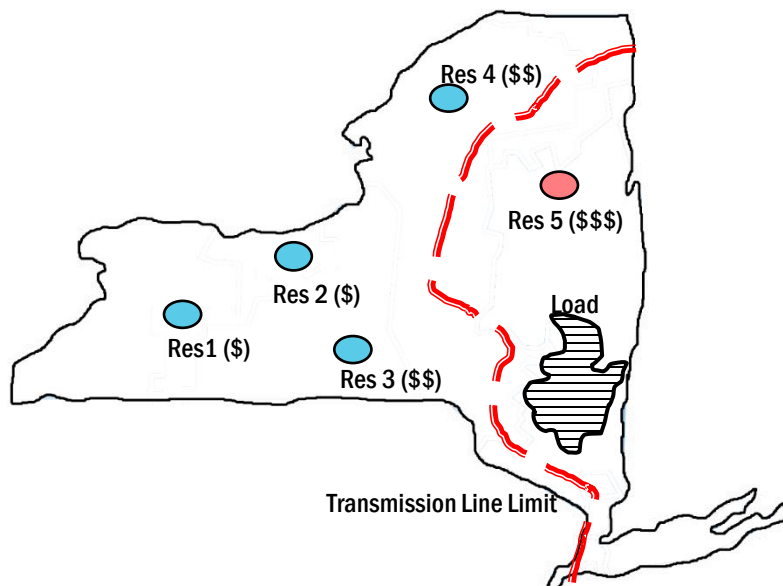
# Determining the Marginal Congestion Price





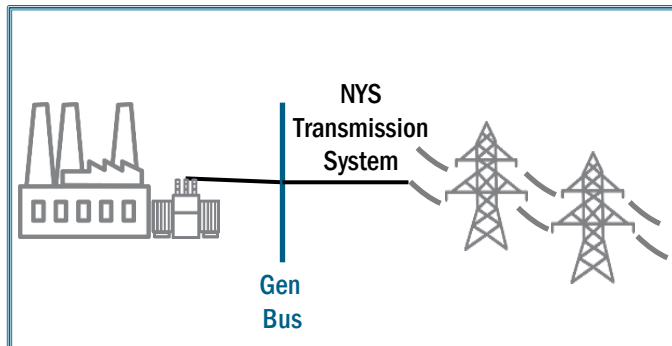
# LBMP - Congestion

- **Marginal Congestion Price Component**
  - Difference between 2 marginal prices creates congestion component



# LBMP for Generators

- Based on Generator Bus
  - LBMP calculated at Bus where Generator injects power

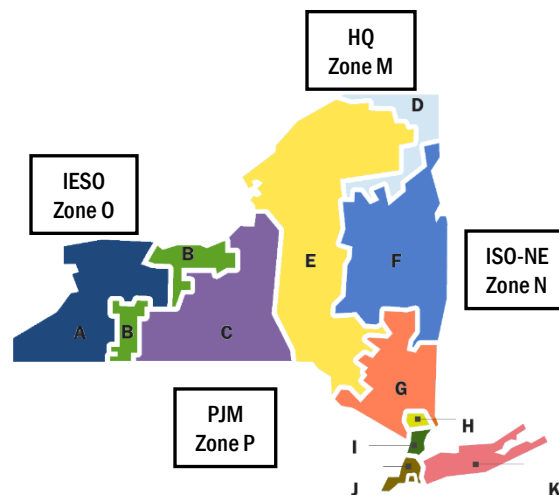


# LBMP for Loads (LSEs)

- Based on Zone where Load is Located
  - One Zonal LBMP for entire Zone
  - Load Weighted Average

## NYCA Load Zones

A- West	E- Mohawk Valley	I- Dunwoodie
B- Genesee	F- Capital	J- NYC
C- Central	G- Hudson Valley	K- Long Island
D- North	H- Millwood	



# LBMP - Examples

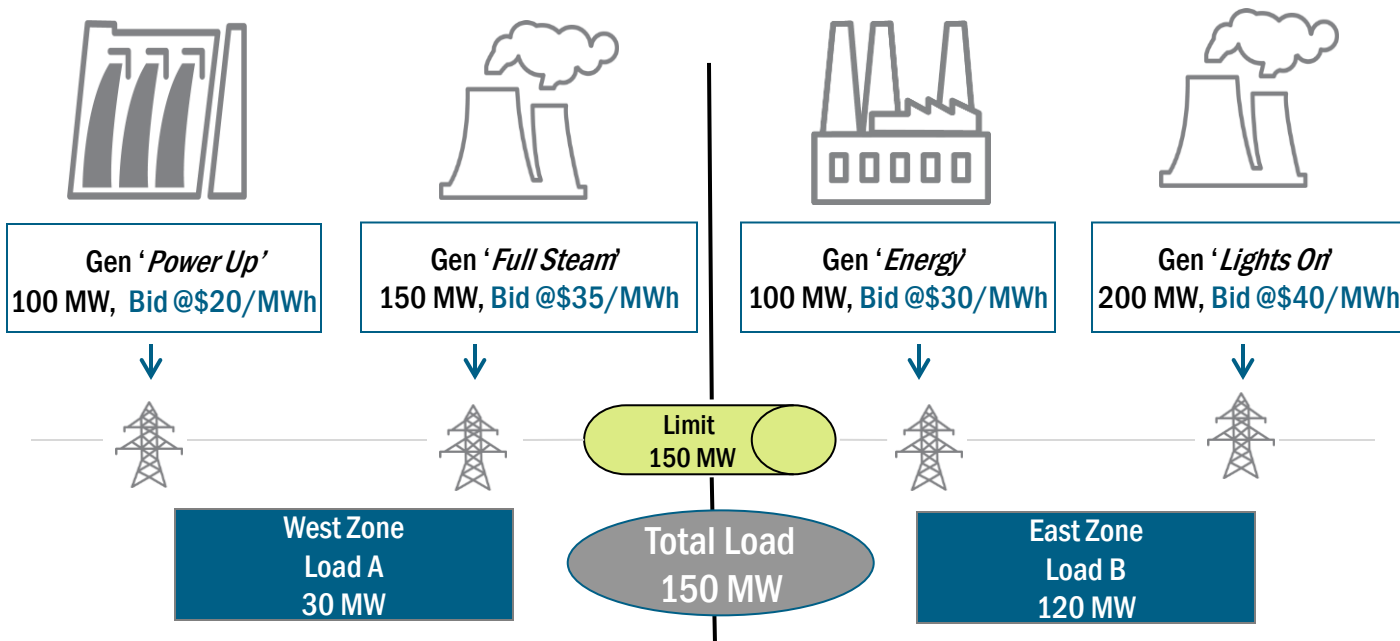
# Example 1: Energy Only

## No Losses and No Congestion

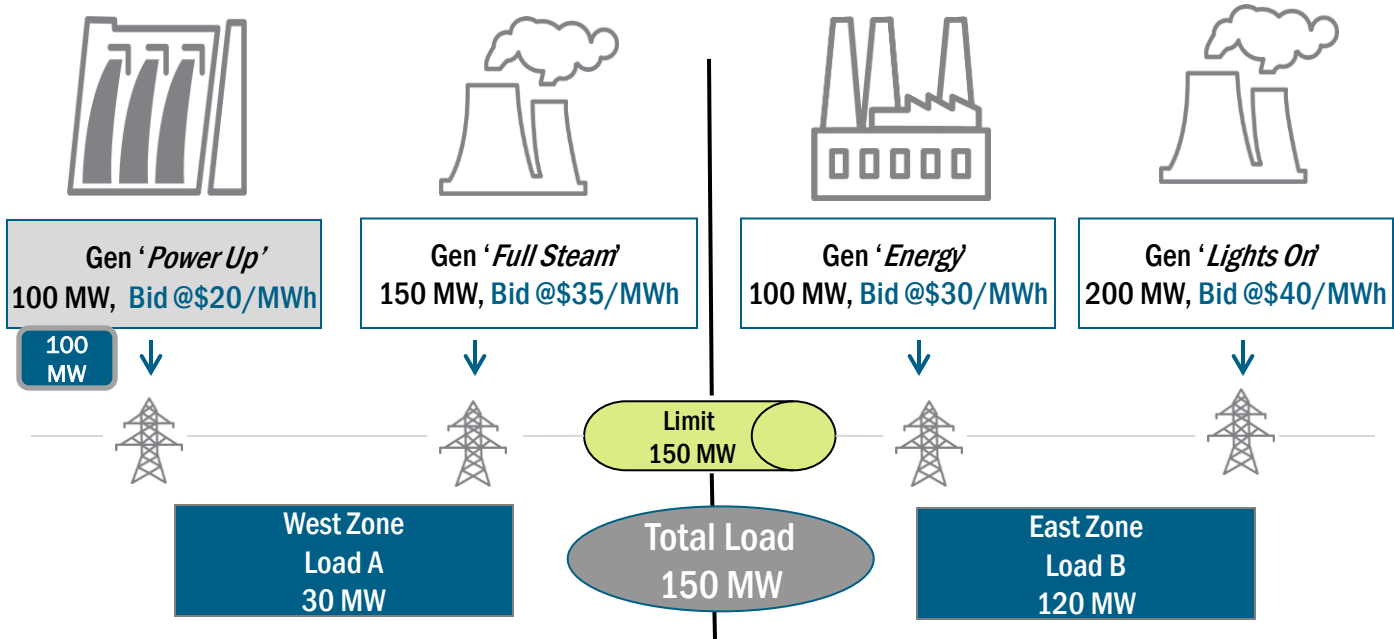


**Total Load = 150 MW**

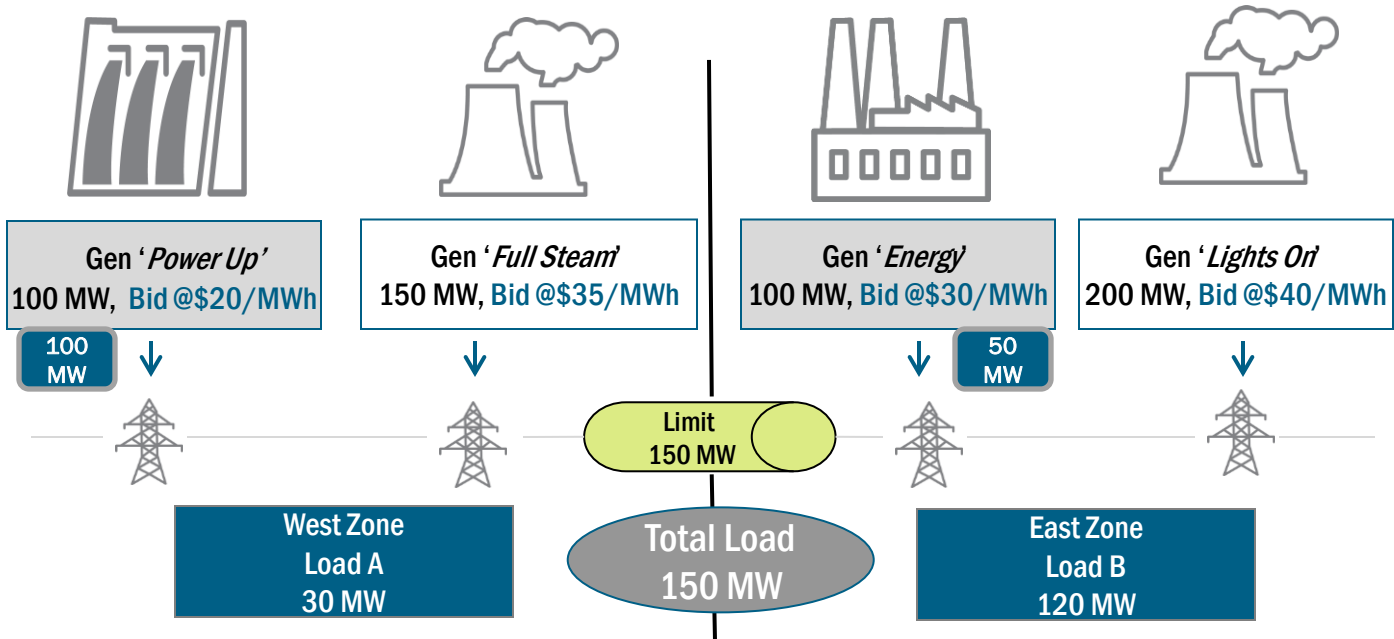
# Example 1: Energy Only



# Example 1: Energy Only

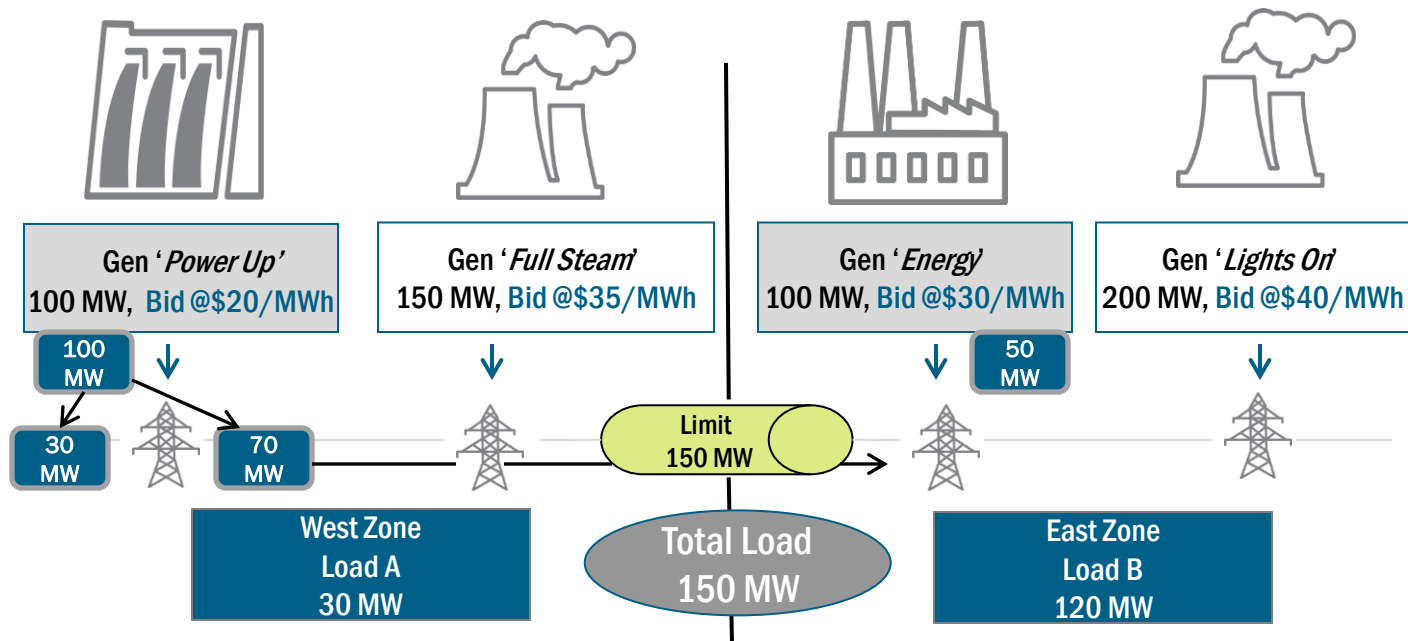


# Example 1: Energy Only

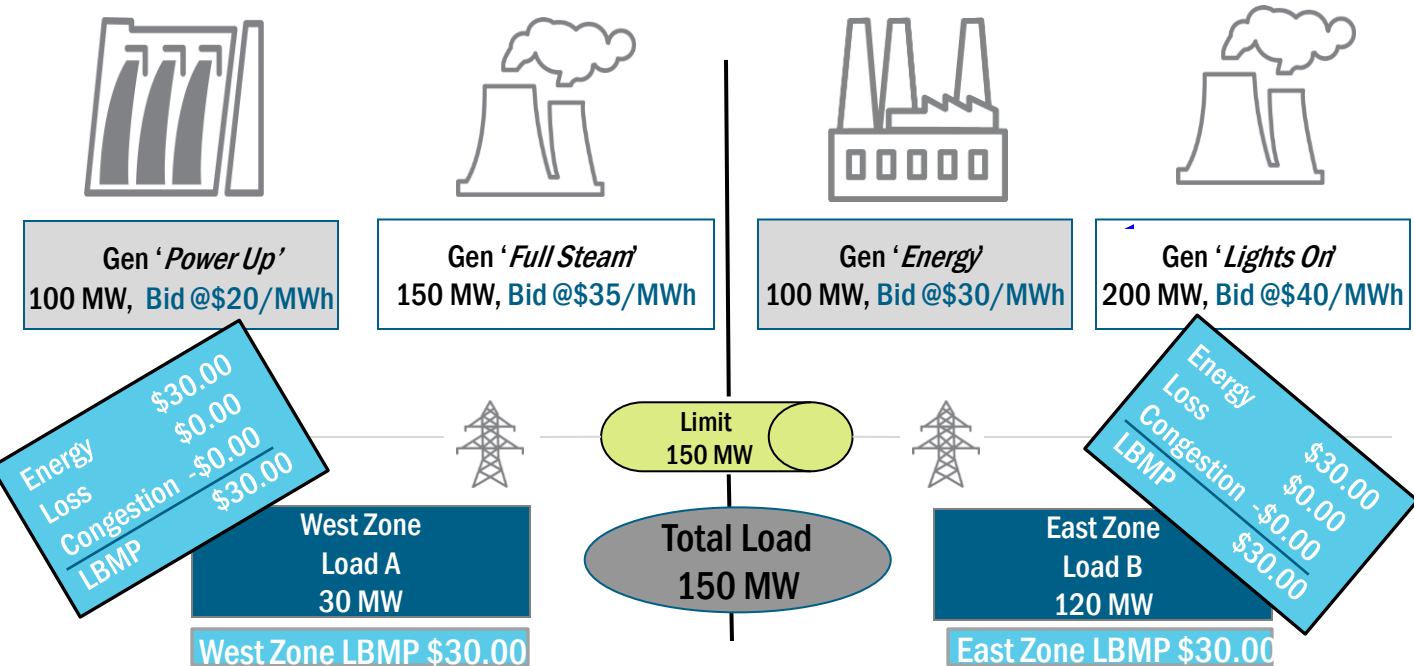




# Example 1: Energy Only



# Example 1: Energy Only - Results



# Example 1: Energy Only - Results



Gen 'Power Up'  
Bid \$20, Paid \$30



Gen 'Full Steam'  
Bid \$35, Paid \$0



Gen 'Energy'  
Bid \$30, Paid \$30



Gen 'Lights On'  
Bid \$40, Paid \$0

West Zone

East Zone

Generators receive \$30/MWh (LBMP)

# Example 1: Energy Only - Results

Loads Charged \$30/MWh (LBMP)



West Zone  
Load A  
30 MW

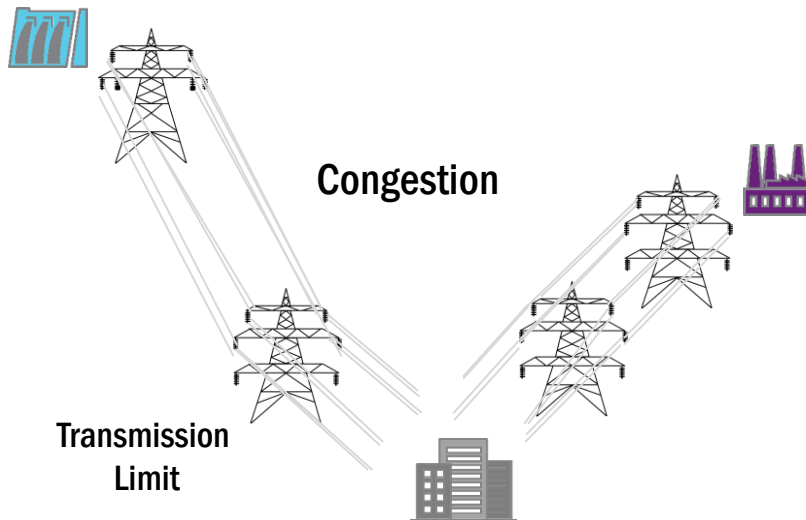


East Zone  
Load B  
120 MW

# Congestion

Congestion occurs when the Power flow reaches the Transmission Limit

- To maintain efficient and reliable Transmission system
  - Transmission limits cannot be exceeded
  - When Transmission limits reached, generators from different buses are dispatched to meet load
- When there is congestion, LBMPs can differ between buses



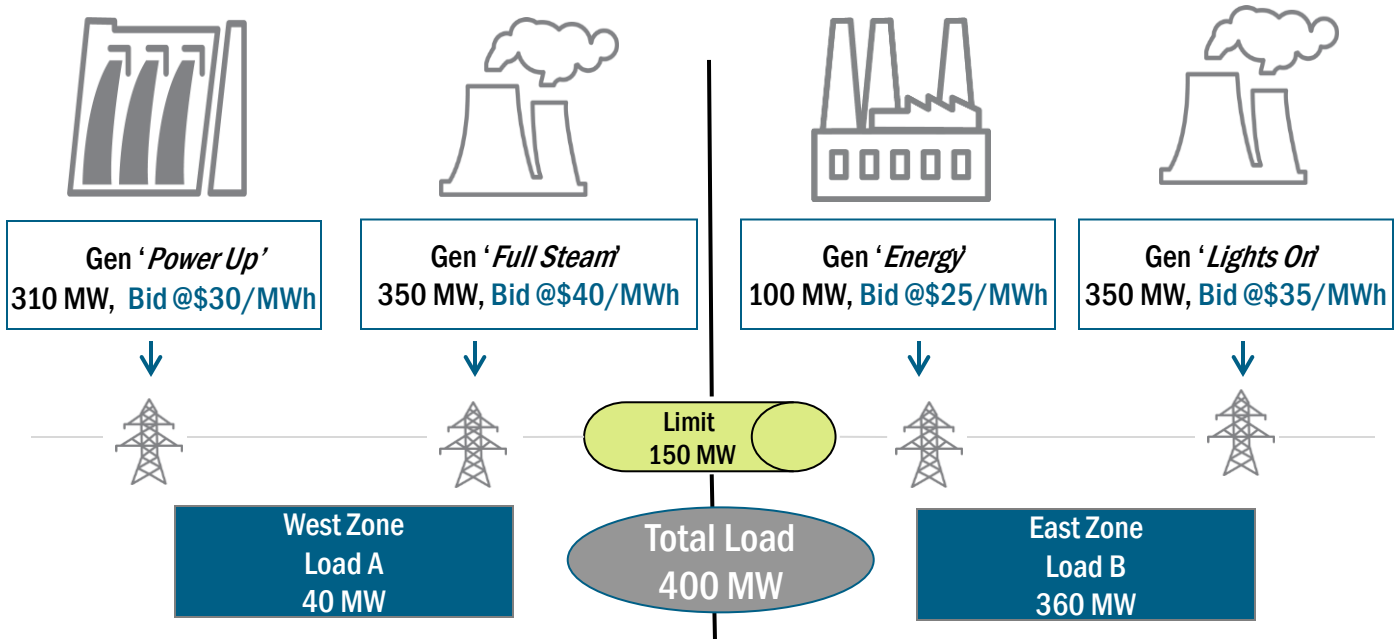
# Example 2: Energy and Congestion

## No Losses

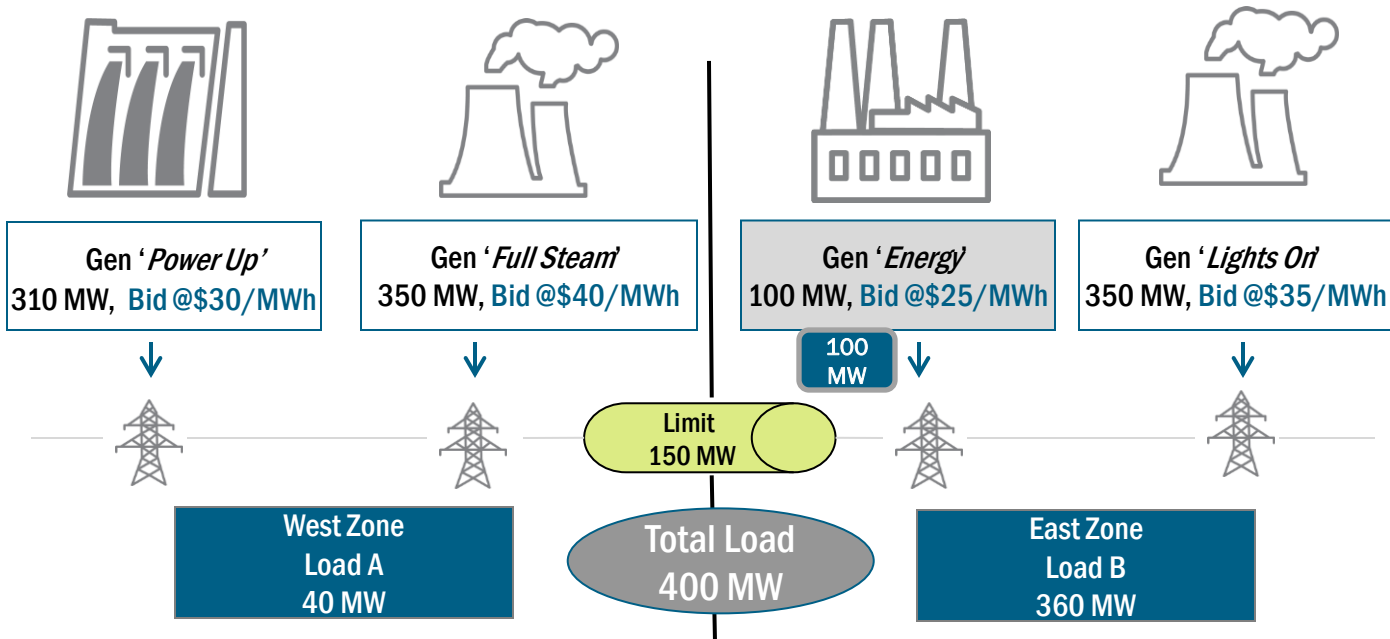


**Total Load**  
**400 MW**

# Example 2: Energy and Congestion

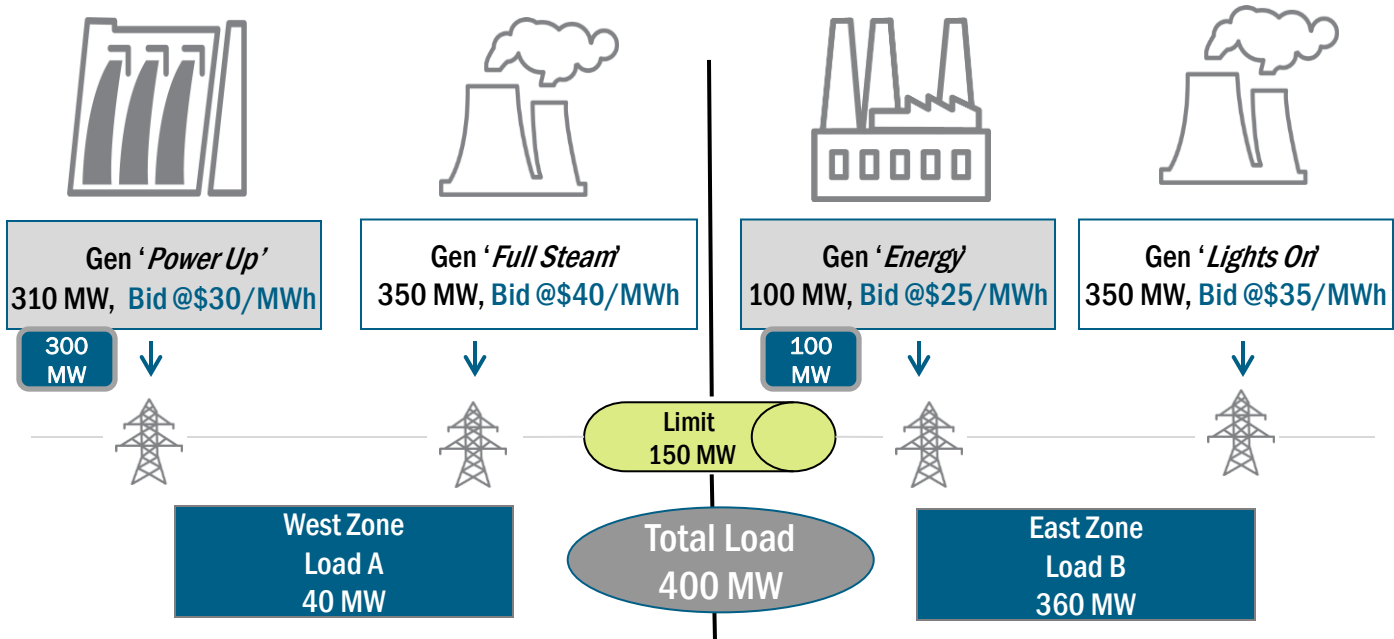


# Example 2: Energy and Congestion

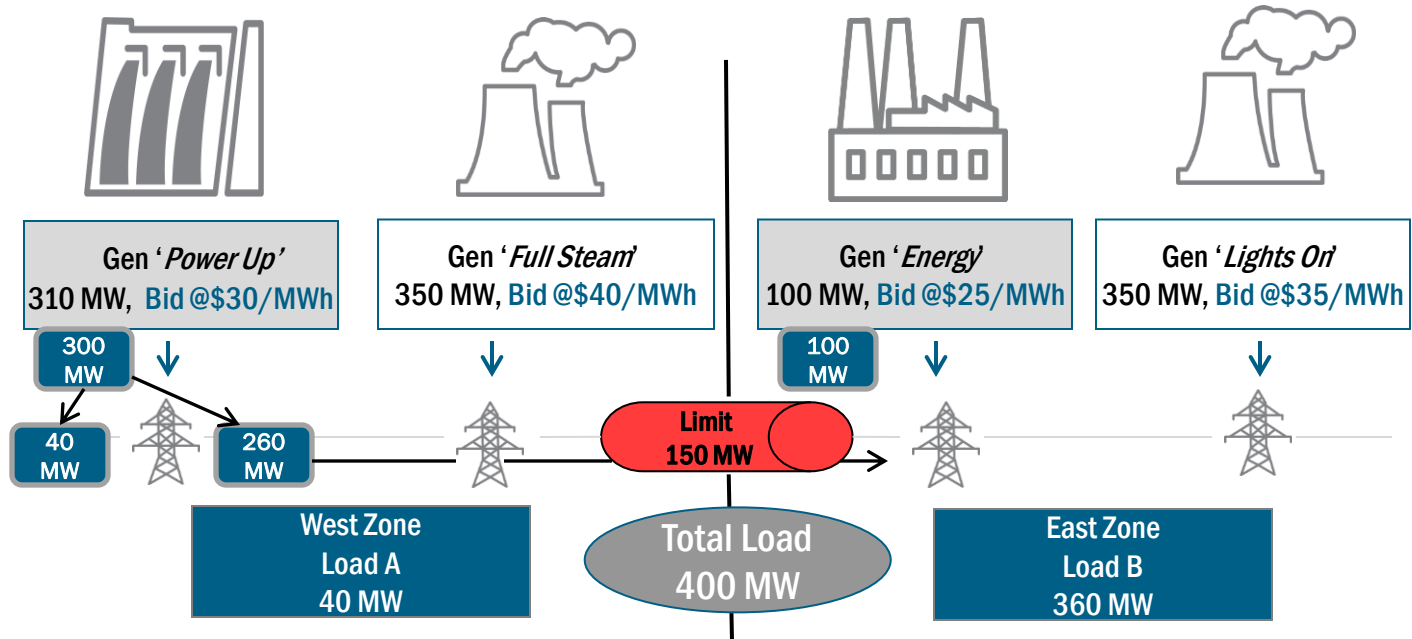




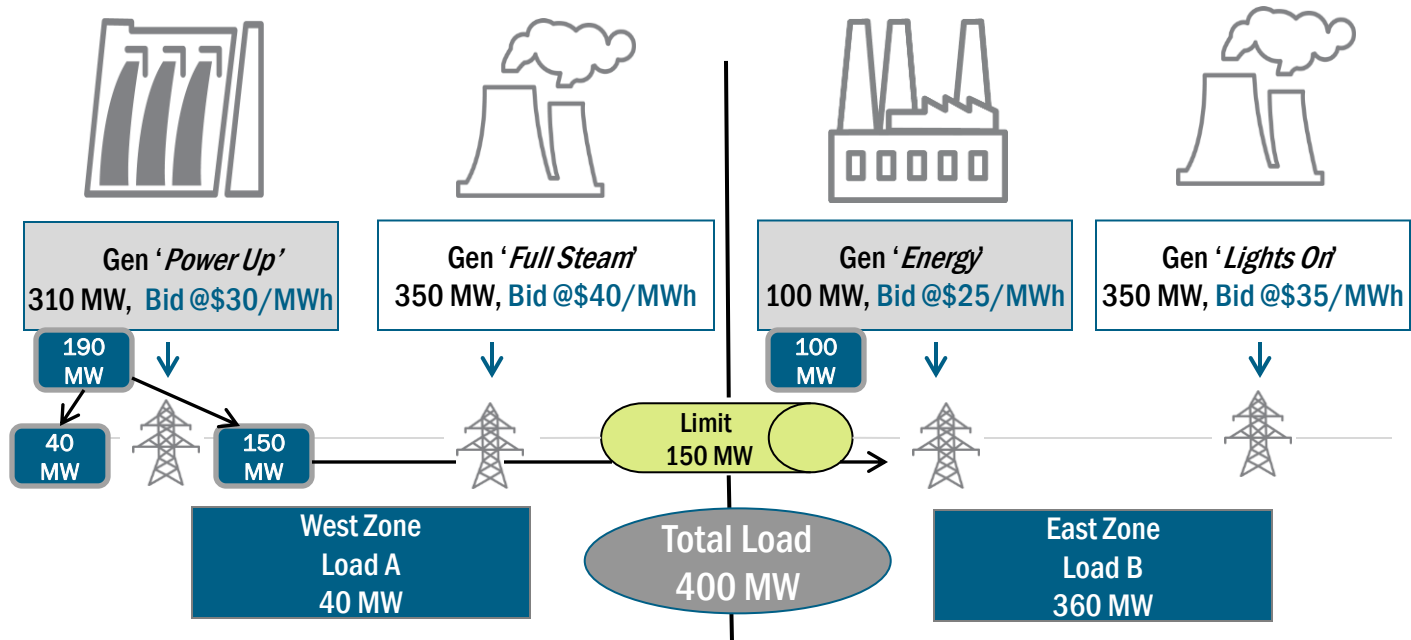
# Example 2: Energy and Congestion



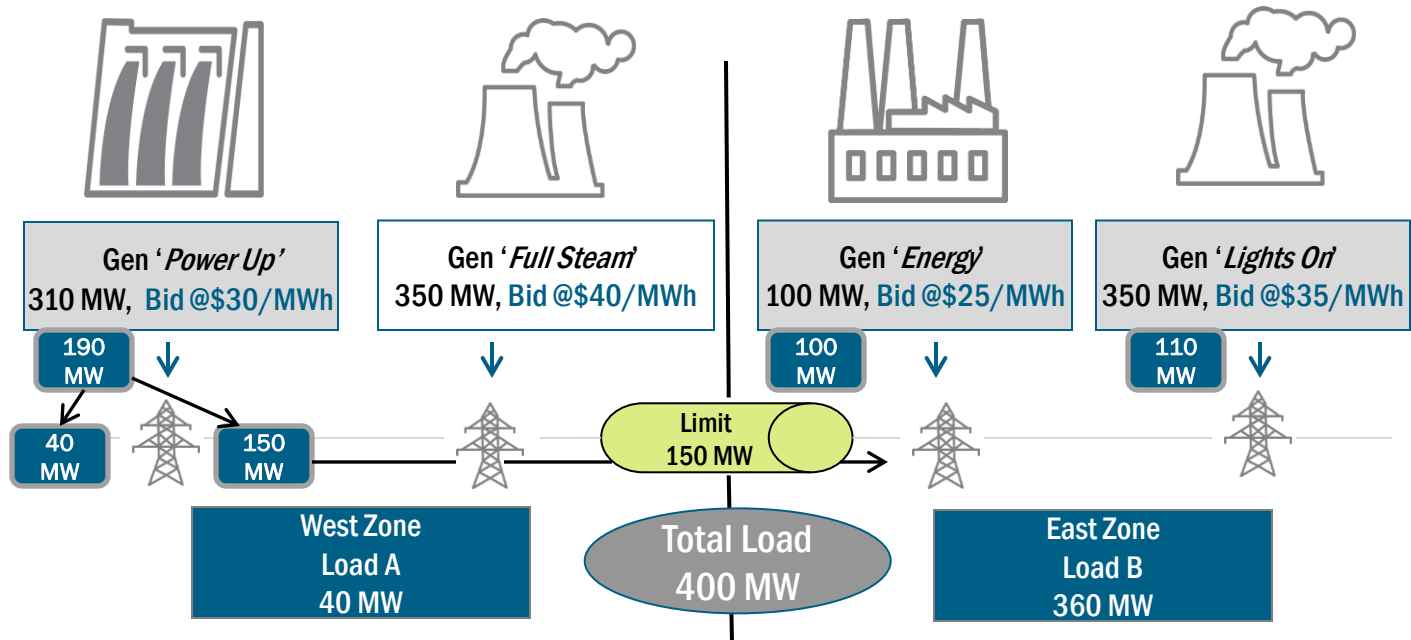
# Example 2: Energy and Congestion



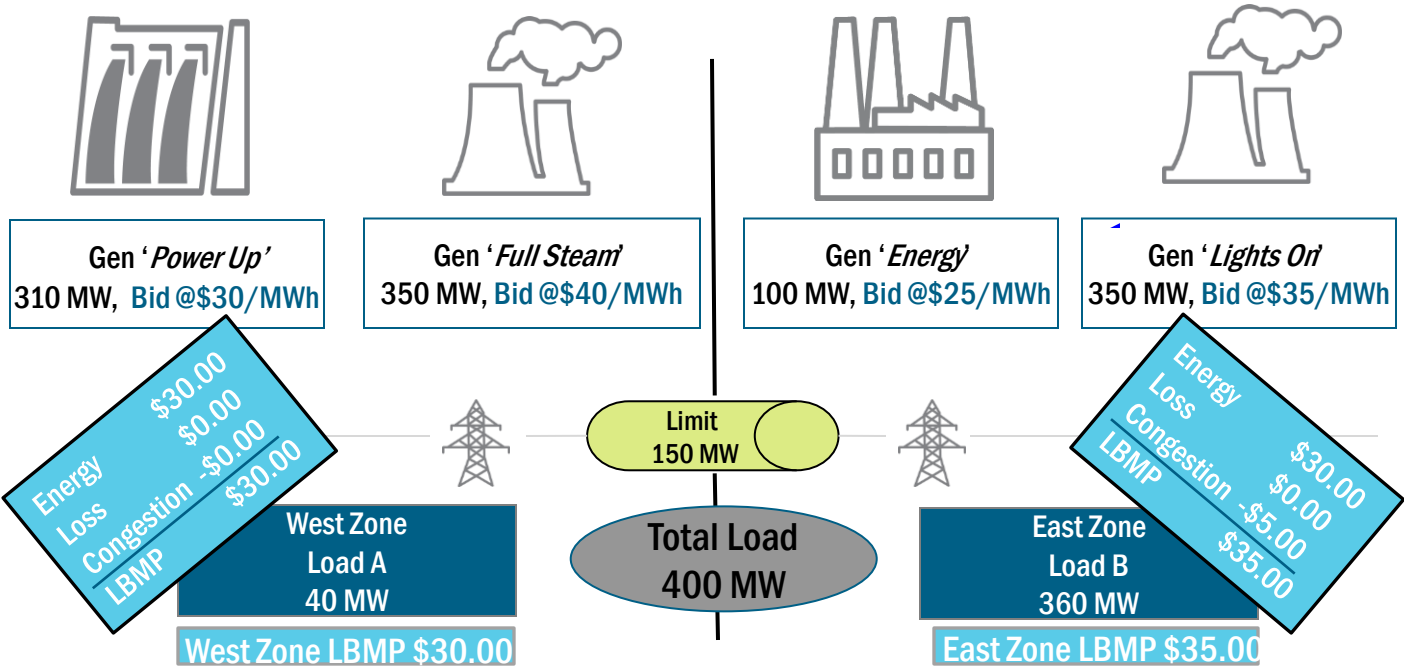
# Example 2: Energy and Congestion



# Example 2: Energy and Congestion



# Example 2: Energy and Congestion - Results



# Example 2: Energy and Congestion - Results



Gen 'Power Up'  
Bid \$30, Paid \$30



Gen 'Full Steam'  
Bid \$40, Paid \$0



Gen 'Energy'  
Bid \$25, Paid ?



Gen 'Lights On'  
Bid \$35, Paid ?

West Zone

East Zone

Generator "Power Up " receives \$30/MWh (LBMP)

# Example 2: Energy and Congestion - Results



Gen 'Power Up'  
Bid \$30, Paid \$30



Gen 'Full Steam'  
Bid \$40, Paid \$0



Gen 'Energy'  
Bid \$25, Paid \$35



Gen 'Lights On'  
Bid \$35, Paid \$35

West Zone

East Zone

Generators, East of the interface receive \$35/MWh (LBMP)

# Example 2: Energy and Congestion - Results

Loads in West Zone  
Charged \$30/MWh (LBMP)



West Zone  
Load A  
40 MW

Loads in East Zone  
Charged \$35/MWh (LBMP)



East Zone  
Load B  
360 MW



# Additional Resources

- Tariffs - OATT & MST
- Day Ahead Scheduling Manual
- Transmission and Dispatching Operations Manual
- Market Participant User's Guide
- Technical Bulletins

# Questions?

For any future assistance, please contact NYISO Stakeholder Services at [stakeholder\\_services@nyiso.com](mailto:stakeholder_services@nyiso.com) or by phone at (518) 356-6060