Loss Price Component

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LBMP In-Depth Course

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Session Topics

- Transmission Losses
- Loss Delivery Factors
- Tariff Loss Calculation
- Application of System Losses

Session Objectives

- **Upon completion of this module, trainees will be able to:**
  - Explain the process for determining NYCA transmission losses
  - Define delivery factor
  - Describe the components of the tariff loss price calculation

Loss Component

LBMP = Energy + Loss - Congestion

Transmission Losses

Transmission Losses

- **Approx. 2.5% of energy is lost along the transmission system due to heat dissipation**
- **Amount of transmission loss is dependent on:**
  - Specific Generation Source
  - Network Topology
    - Expected Power Flows
    - Expected Unscheduled Power Flows
    - Internal & External Coordinated Transmission Facility Outages

Transmission Losses

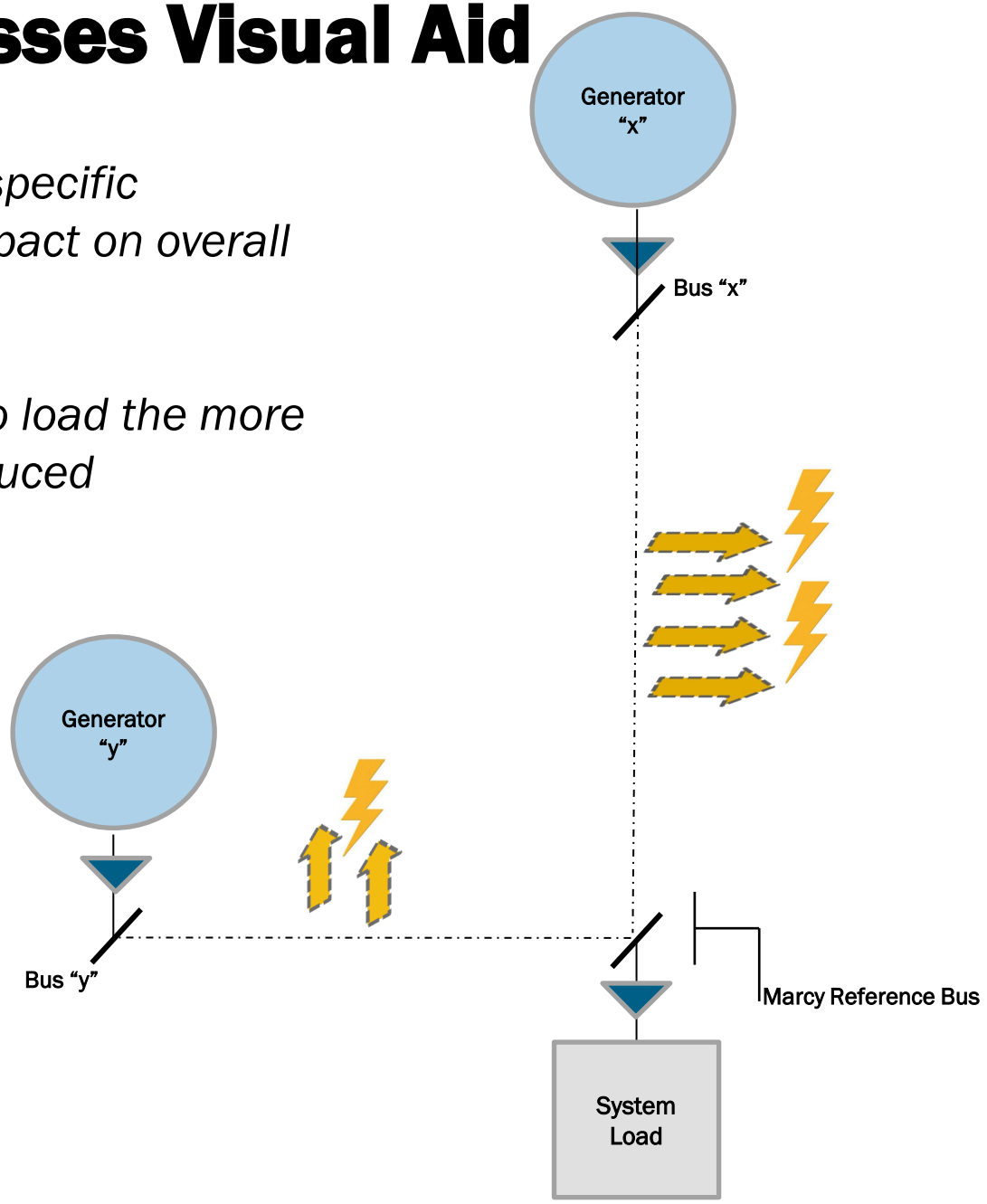
- **Energy Balance Relationship to Losses**
  - Represents required increase in Generator output at given bus to supply transmission losses at Reference Bus, appears as an increase in Load
    - With all other loads held constant

Increment of Generation = Increment of Load + Increment of Losses

Transmission Losses Visual Aid

When power is injected at a specific Generator bus there is an impact on overall system losses…

The closer the Generator is to load the more likely it is for losses to be reduced



Loss Delivery Factors

Loss Delivery Factors

- **Delivery Factors**
  - Approximate the effects of changes in generation on transmission losses
    - Indicating impact on overall system losses
  - Reflect expected network topology for
    - Given time-period
    - Corresponding generation dispatch
  - Are used to calculate marginal loss components of LBMPs

Loss Delivery Factors

- **Resulting Impact on Overall System Losses**
  - Delivery factor equals amount of power that could be delivered to a Load at Reference Bus if generation at source is increased by 1 MW
  - The greater the impact on system losses, the greater the impact on marginal loss price component

Delivery Factor	Impact on System Loss	Marginal Loss Price Component
>1	Decreases System Loss	Positive $
<1	Increases System Loss	Negative $

Loss Delivery Factors

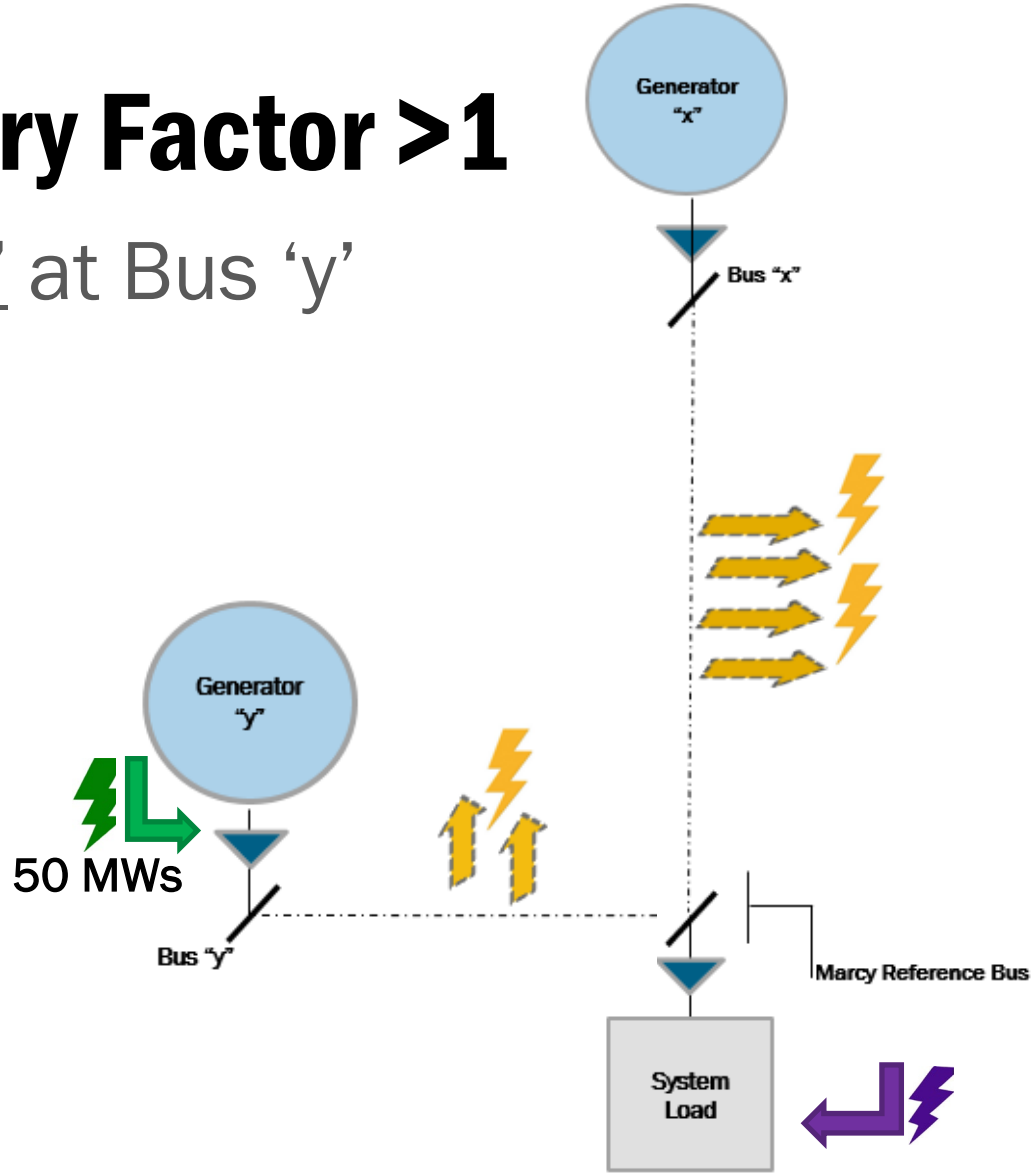
- **Delivery Factor Formula**
  - Accounts for incremental NYCA losses and increment of power injection at a given Generator bus

Delivery Factor $_{\text{at given gen bus}}$ =
(1 – Incremental NYCA Losses/Increment of Injection $_{\text{at given gen bus}}$*)*

Delivery Factor > 1

Simple Two Line/Three Bus Diagram

- **Example A: Delivery Factor >1**
  - Calc DF for **Gen 'y'** at Bus 'y'



Legend

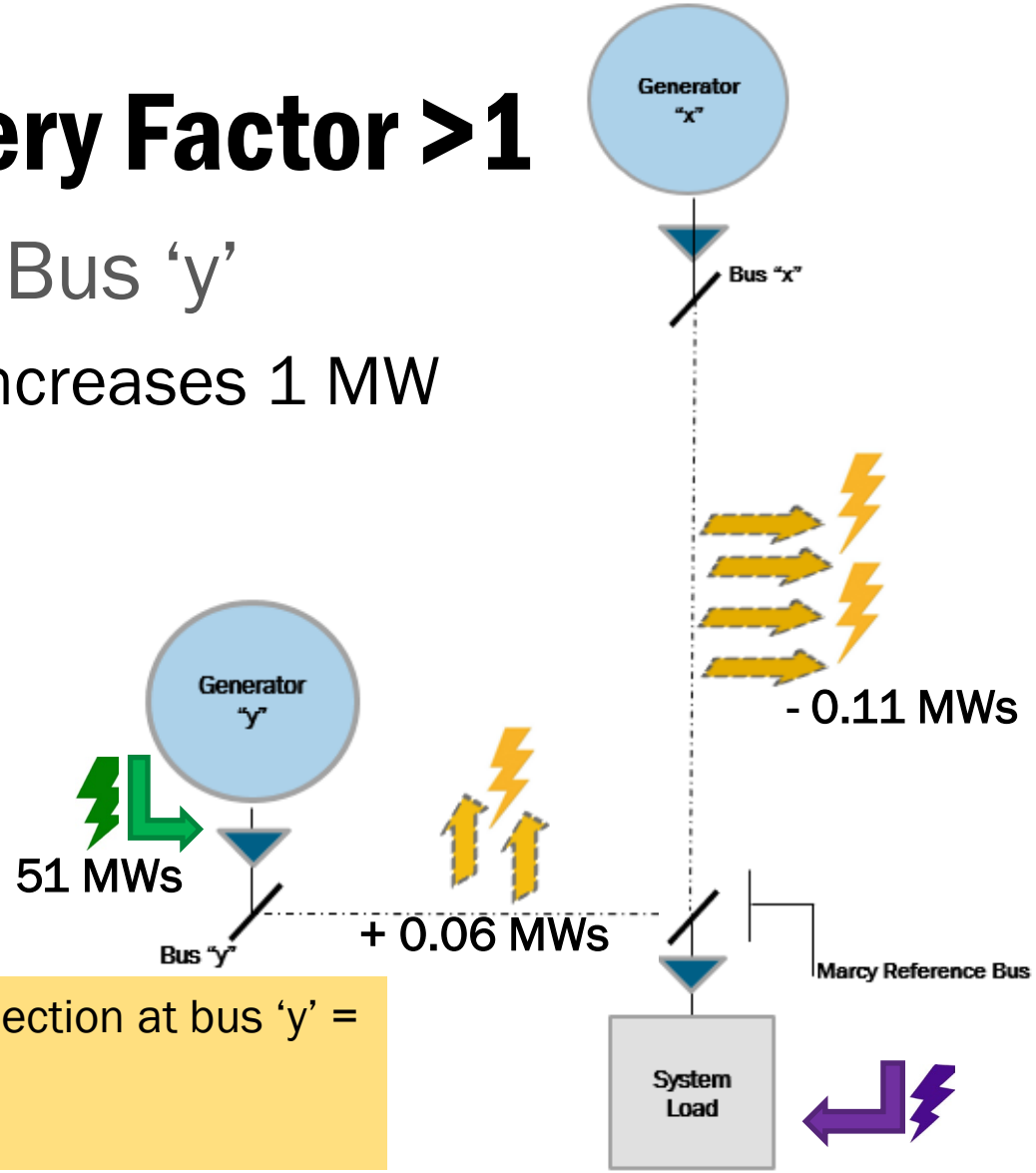
MW Injected

MW Loss

MW Consumed

Simple Two Line/Three Bus Diagram

- **Example A : Delivery Factor >1**
  - Calc for **Gen 'y'** at Bus 'y'
    - Gen 'y' injection increases 1 MW



Legend

MW Injected

MW Loss

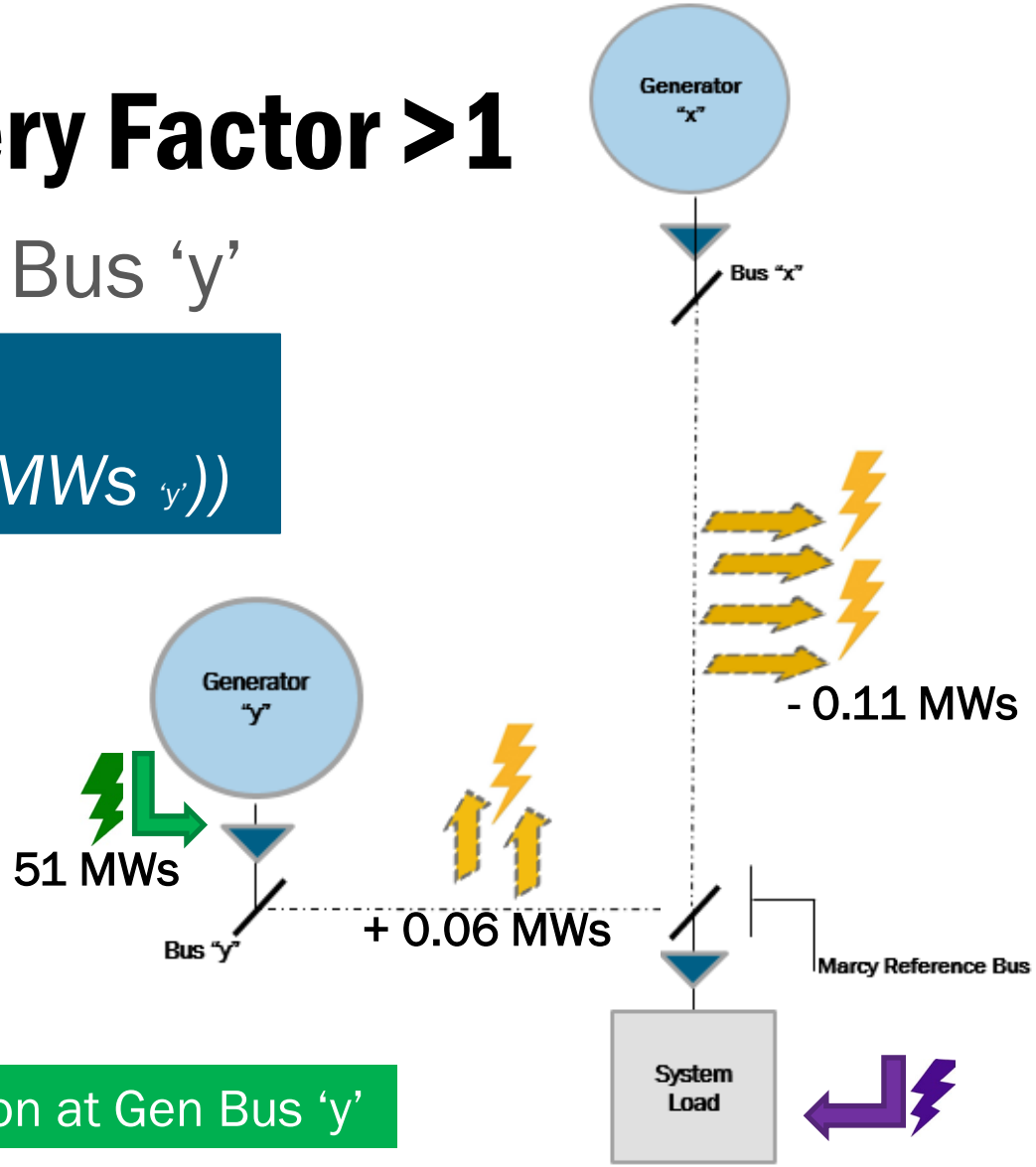
MW Consumed

Resultant loss on transmission system due to injection at bus 'y' =
0.06 + (- 0.11)
- 0.05

Simple Two Line/Three Bus Diagram

- **Example A: Delivery Factor >1**
  - Calc for **Gen 'y'** at Bus 'y'

$$1.05_{\text{'y'}} = (1 - (-0.05\ \text{MWs}/(51\text{-}50)\ \text{MWs}_{\text{'y'}}))$$



Legend

MW Injected

MW Loss

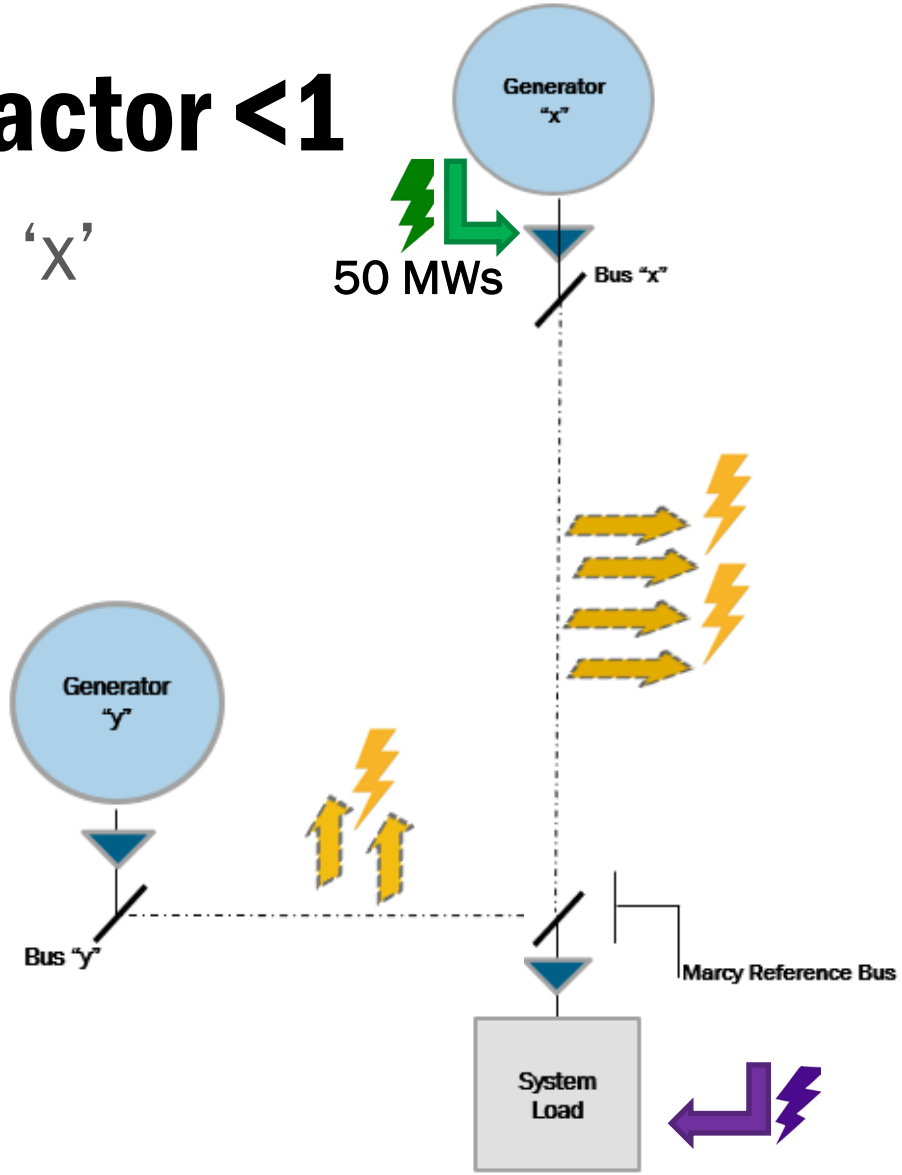
MW Consumed

Decrease in total system loss due to injection at Gen Bus 'y'

Delivery Factor < 1

Simple Two Line/Three Bus Diagram

- **Example B: Delivery Factor <1**
  - Calc DF for **Gen 'x'** Bus 'x'



Legend

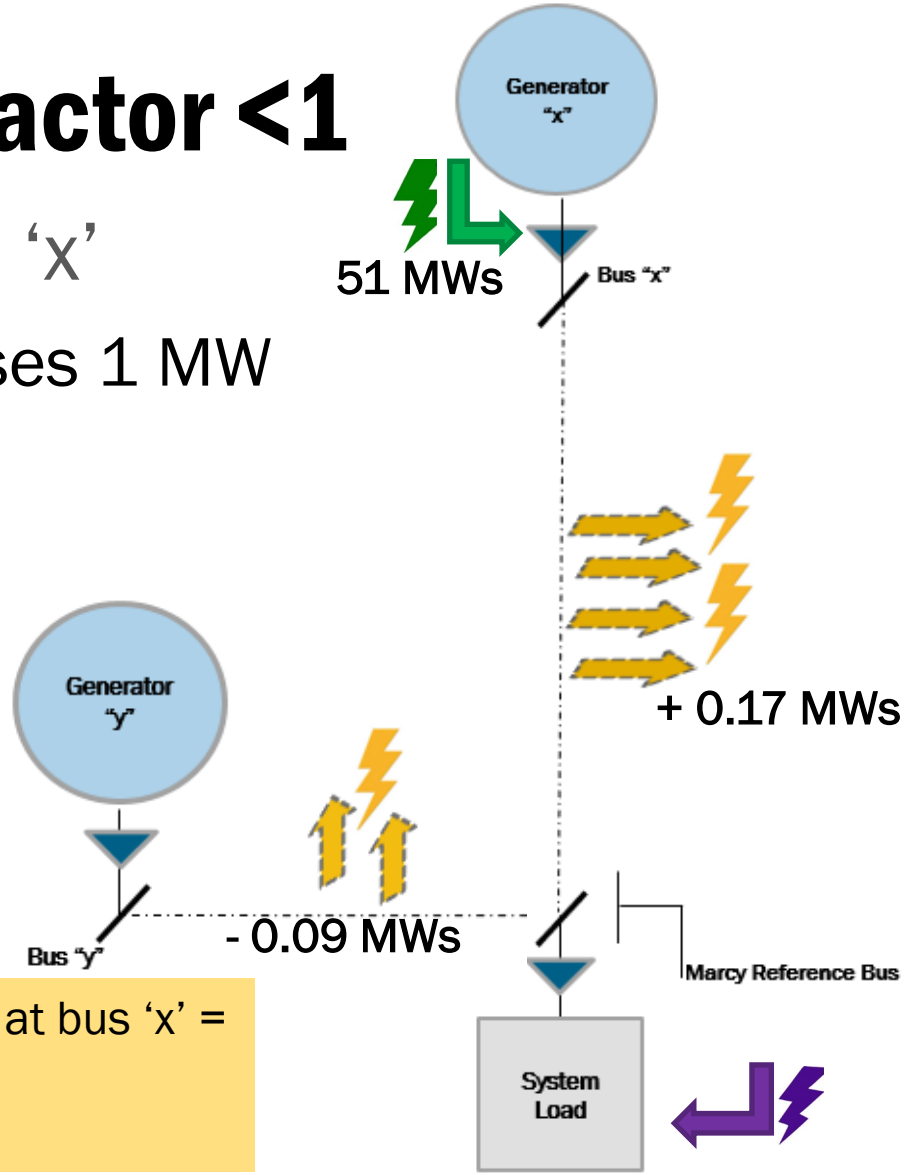
MW Injected

MW Loss

MW Consumed

Simple Two Line/Three Bus Diagram

- **Example B: Delivery Factor <1**
  - Calc DF for **Gen 'x'** Bus 'x'
    - Gen 'x' injection increases 1 MW



Legend

MW Injected

MW Loss

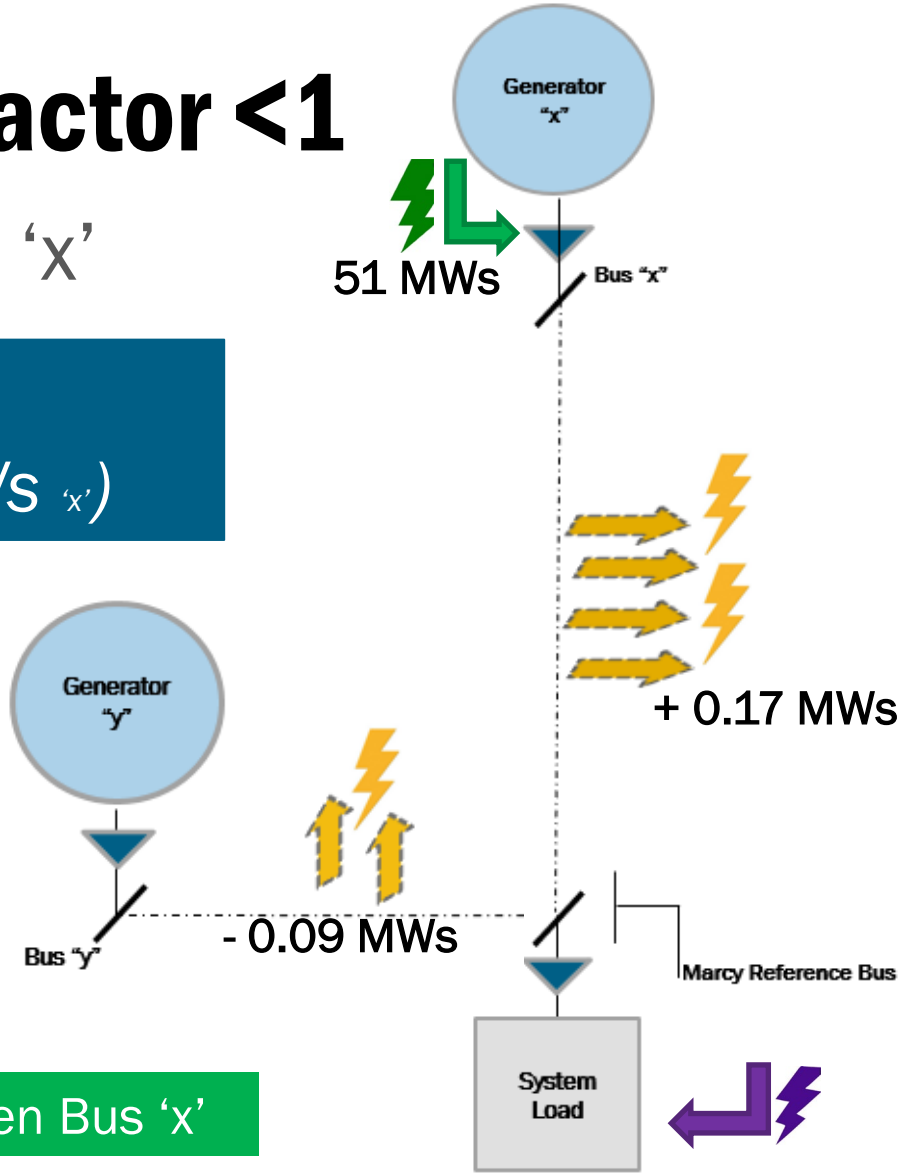
MW Consumed

Resultant loss on transmission system due to injection at bus 'x' =
- 0.09 + 0.17
0.08

Simple Two Line/Three Bus Diagram

- **Example B: Delivery Factor <1**
  - Calc DF for **Gen 'x'** Bus 'x'

0.92 'x' =
1 – (0.08 MWs/(51-50) MWs 'x')



Legend

MW Injected

MW Loss

MW Consumed

Increase in total system loss due to injection at Gen Bus 'x'

Tariff Loss Calculation

LBMP Loss: Generator Calculation

- Loss Component for a Generator is calculated at the Generator bus

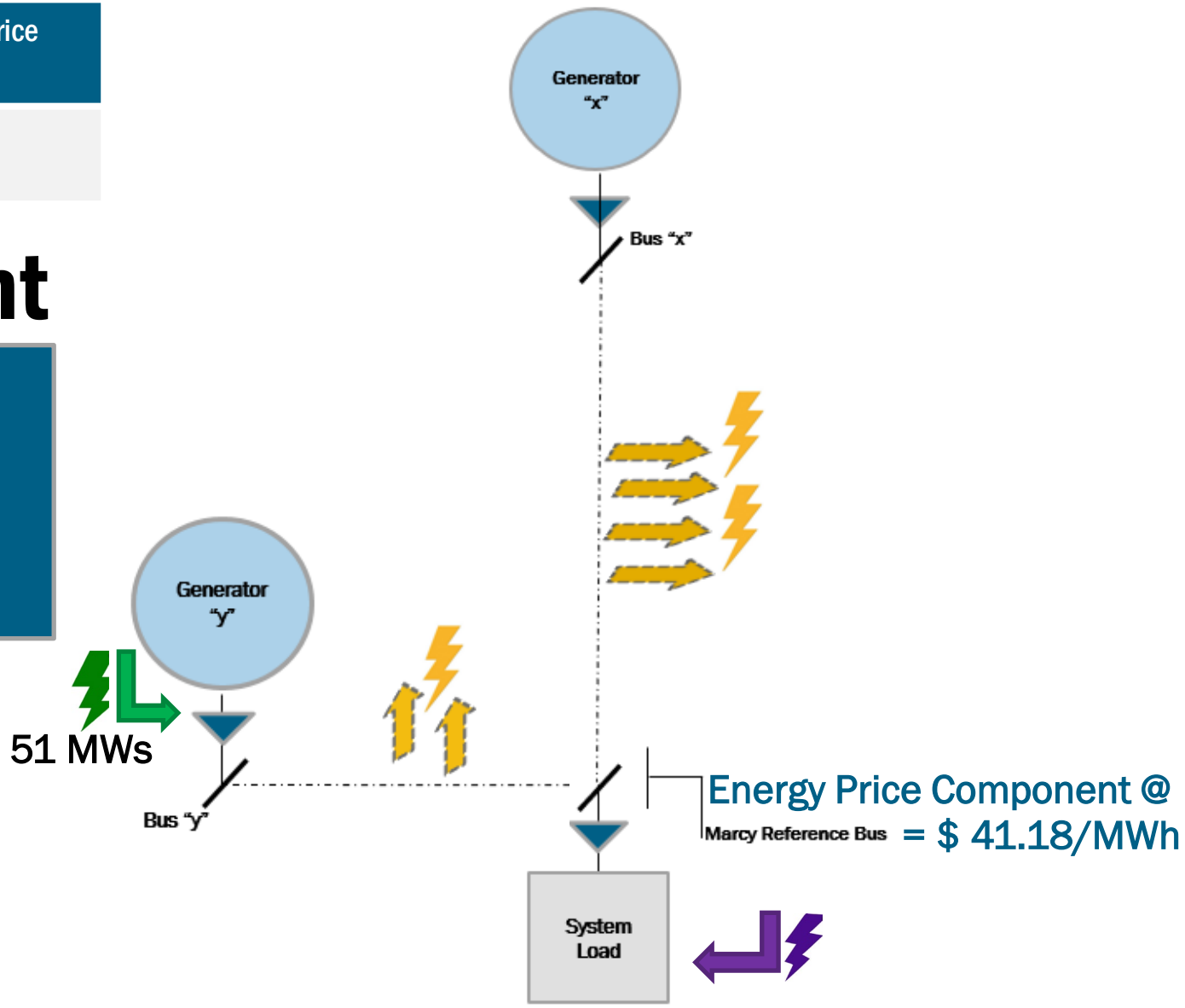
Gen Bus LBMP Loss Component = (Delivery Factor – 1) * Reference Bus Energy Price Component

Positive Loss $ Example

Delivery Factor	Impact on System Loss	Marginal Loss Price Component
>1	Decreases System Loss	Positive $

- **Loss Price Component**

Gen Bus ‘y’ Loss Price =
(1.05 – 1) * 41.18
0.05 * 41.18
$2.06

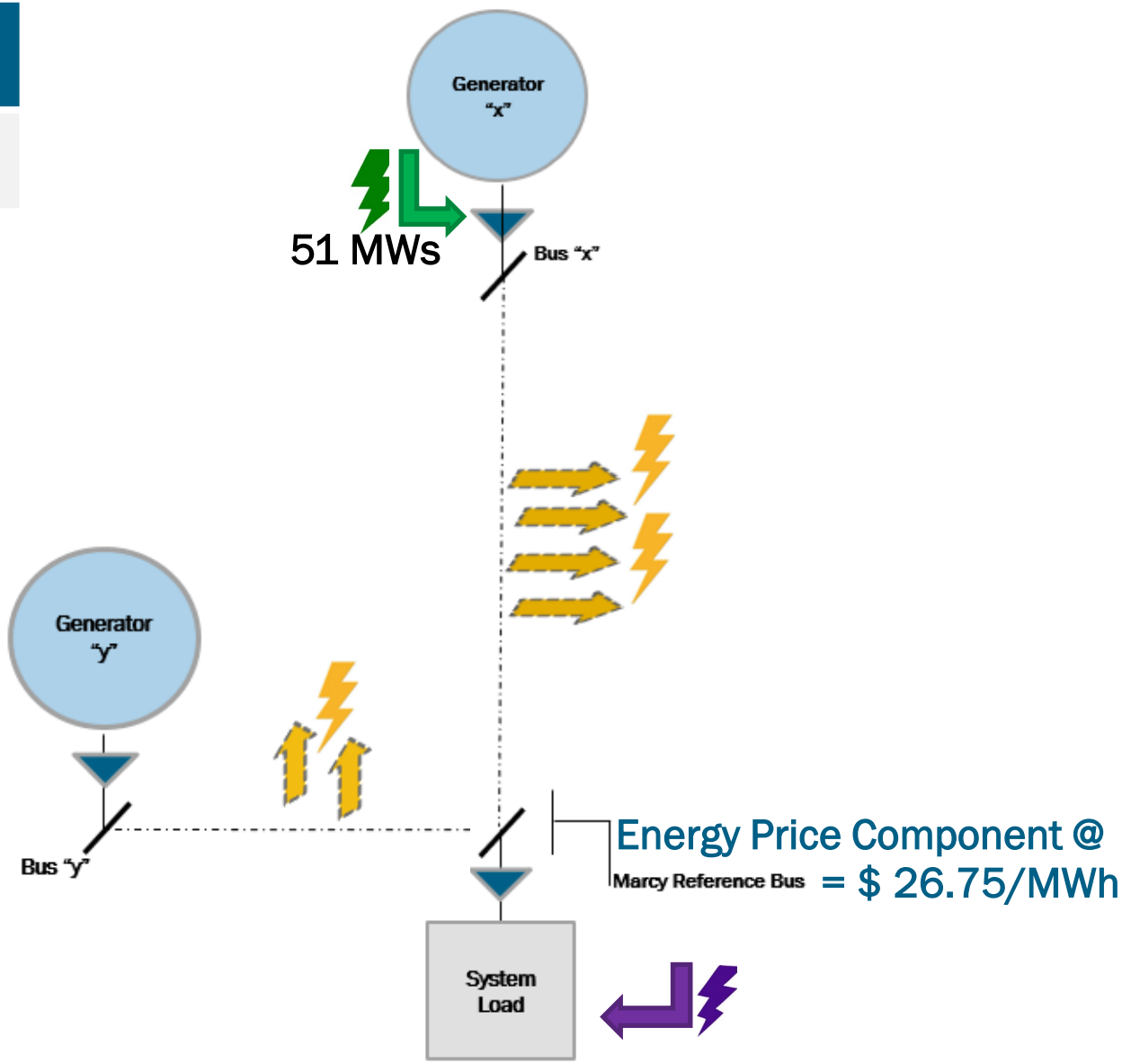


Negative Loss $ Example

Delivery Factor	Impact on System Loss	Marginal Loss Price Component
<1	Increases System Loss	Negative $

- **Loss Price Component**

Gen Bus 'x' Loss Price =
(0.92 – 1) * 26.75
-0.08 * 26.75
-$2.14

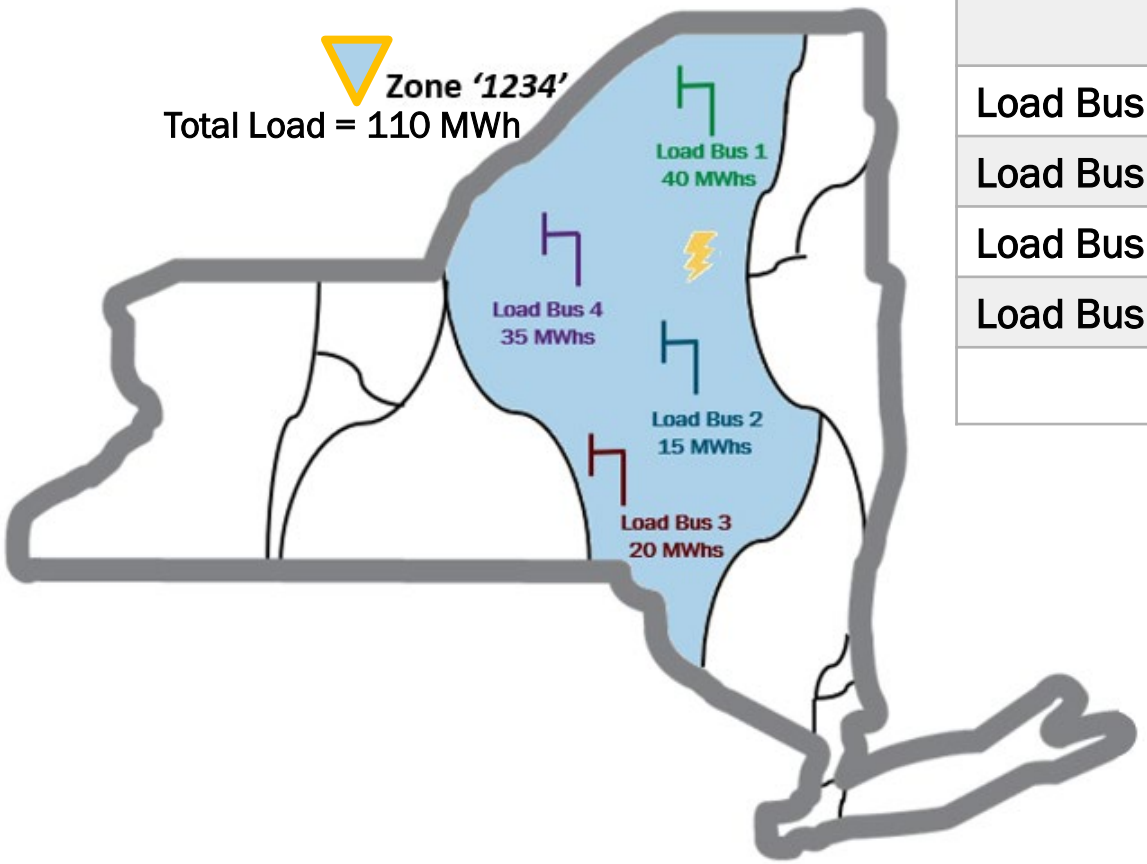


LBMP Loss: Load Calculation

- Loss component for Load is calculated at the respective Load Zone
  - LBMP for a zone will be a Load weighted average of the Load bus LBMPs in the Load Zone, rendering one zonal LBMP for entire zone
    - Load weights which will sum to unity will be calculated from the load bus MW distribution

Zonal LBMP Loss Component = ∑of each bus (Load Bus Weighting * Marginal Load Bus Loss)

Load Calculation Summary - Example

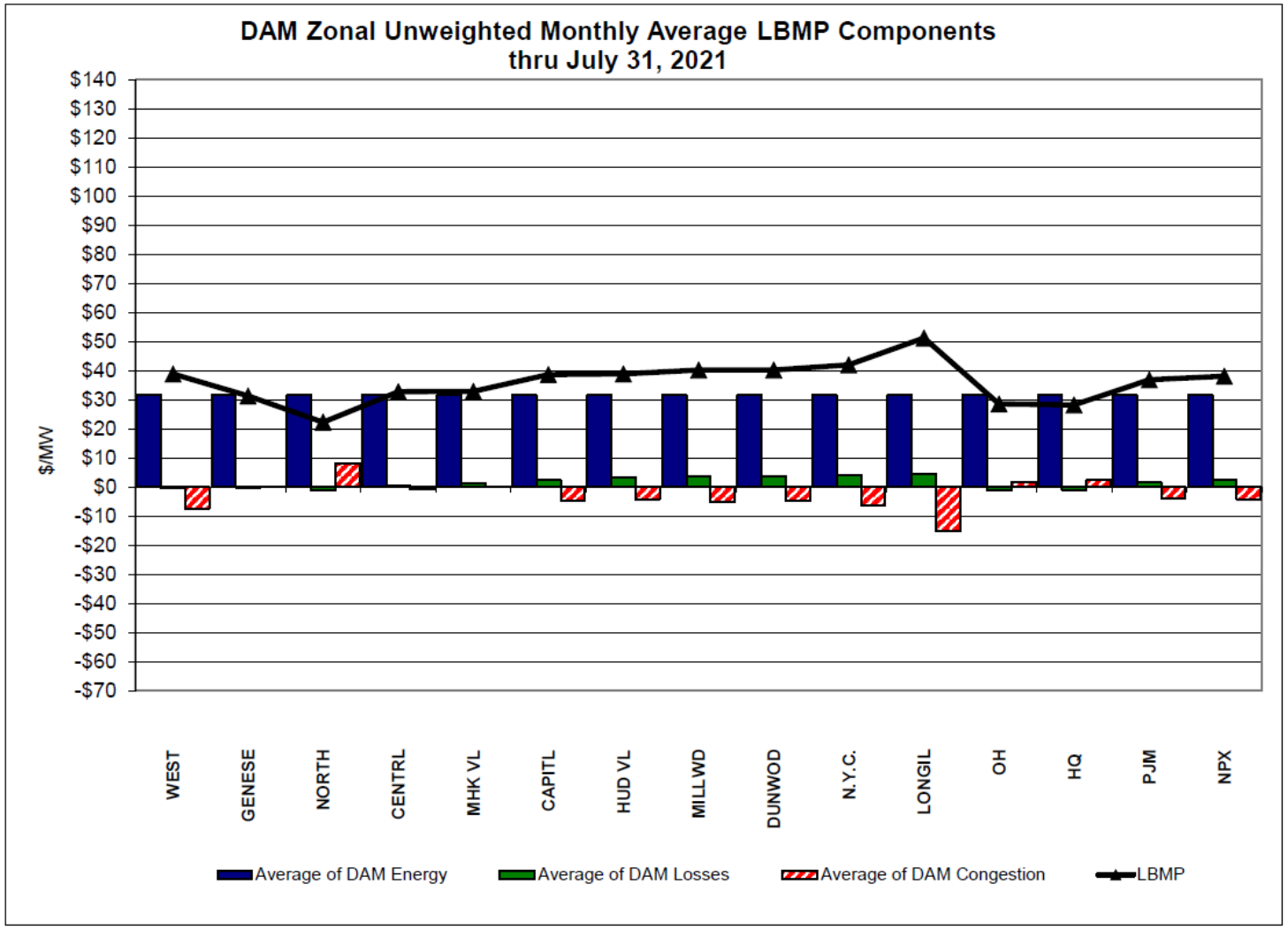


Calculating Zonal Loss using Load Weighted Average			
	Load Weighted Value	Loss Price	Weighted Loss Price
Load Bus 1	40/110 = 0.36	$1.50	$0.54
Load Bus 2	15/110 = 0.14	$1	$0.14
Load Bus 3	20/110 = 0.18	$2.25	$0.41
Load Bus 4	35/110 = 0.32	$1.75	$0.56
		Zone '*1234*' Loss Price Component	$1.65

Application of System Losses

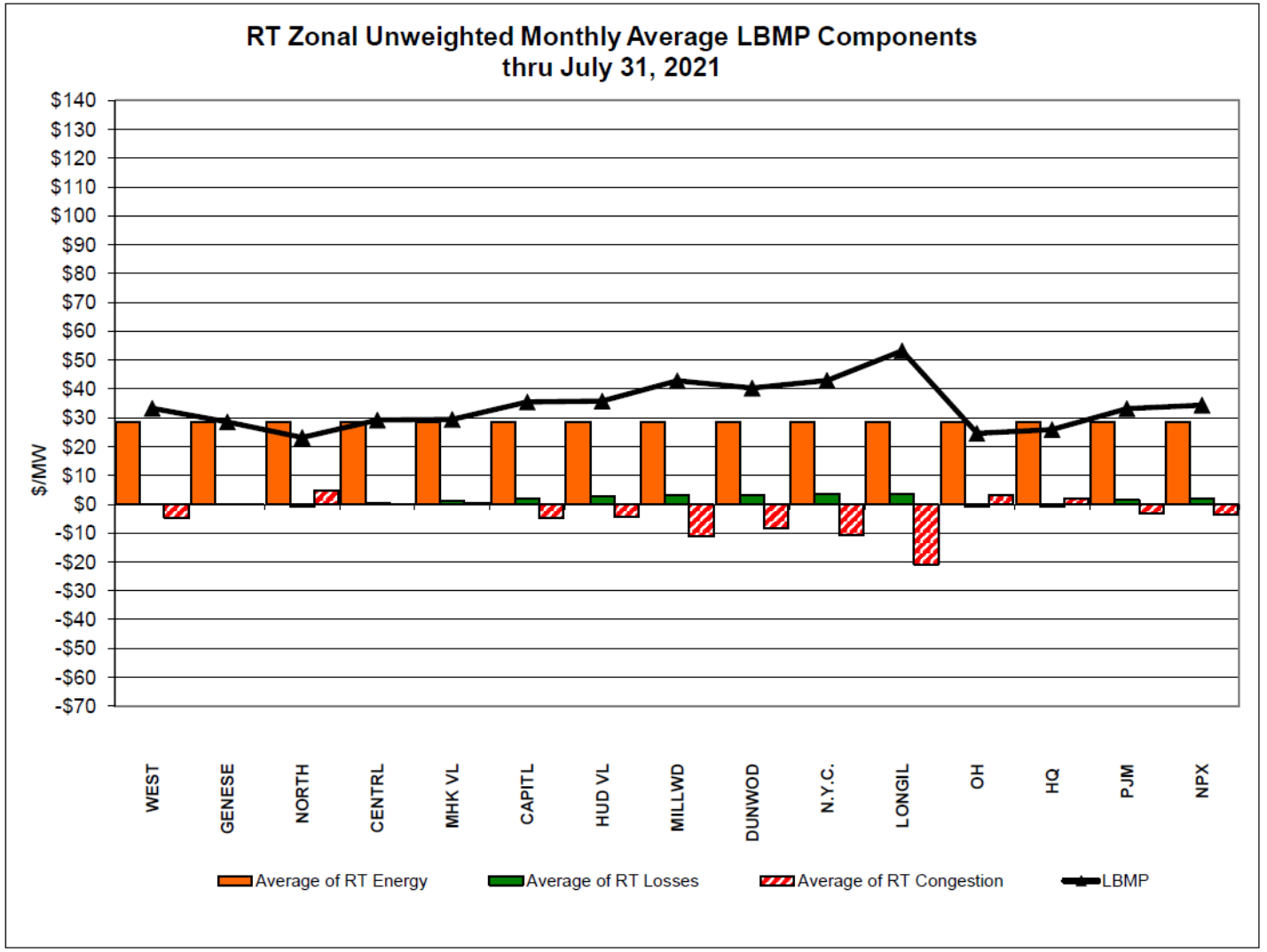
NYISO Monthly Report for July 2021

Day Ahead Market



NYISO Monthly Report for July 2021

Real Time Market



Summary

- Determining NYCA Transmission Losses
- Generator Delivery Factor
- Components of Tariff Loss Price Calculation
- Application of System Losses

Additional Resources

- Tariffs - OATT and MST
  - OATT Attachment J
  - MST Attachment B
- Market Participant User's Guide 3.3.1
- Day-Ahead Scheduling Manual
- Transmission and Dispatch Manual