



# Transmission Expansion Analysis

Andrew Ott

PJM Vice President, Markets

May 31, 2007



- Expansion ordered by PJM because of Reliability Violation
- Expansion recommended by PJM based on economics
- Voluntary Investment
  - Merchant generation interconnection
  - Financial transmission rights
  - Other property rights

- Annual market simulations
- Base input assumptions regarding generating unit characteristics, fuel costs, emissions costs, load forecasts, etc.

## Sensitivity analysis:

- High/Low fuel prices
  - High/Low demand
  - High/Low future generation
  - High/Low emissions costs
  - High/Low discount rates<sup>3</sup>

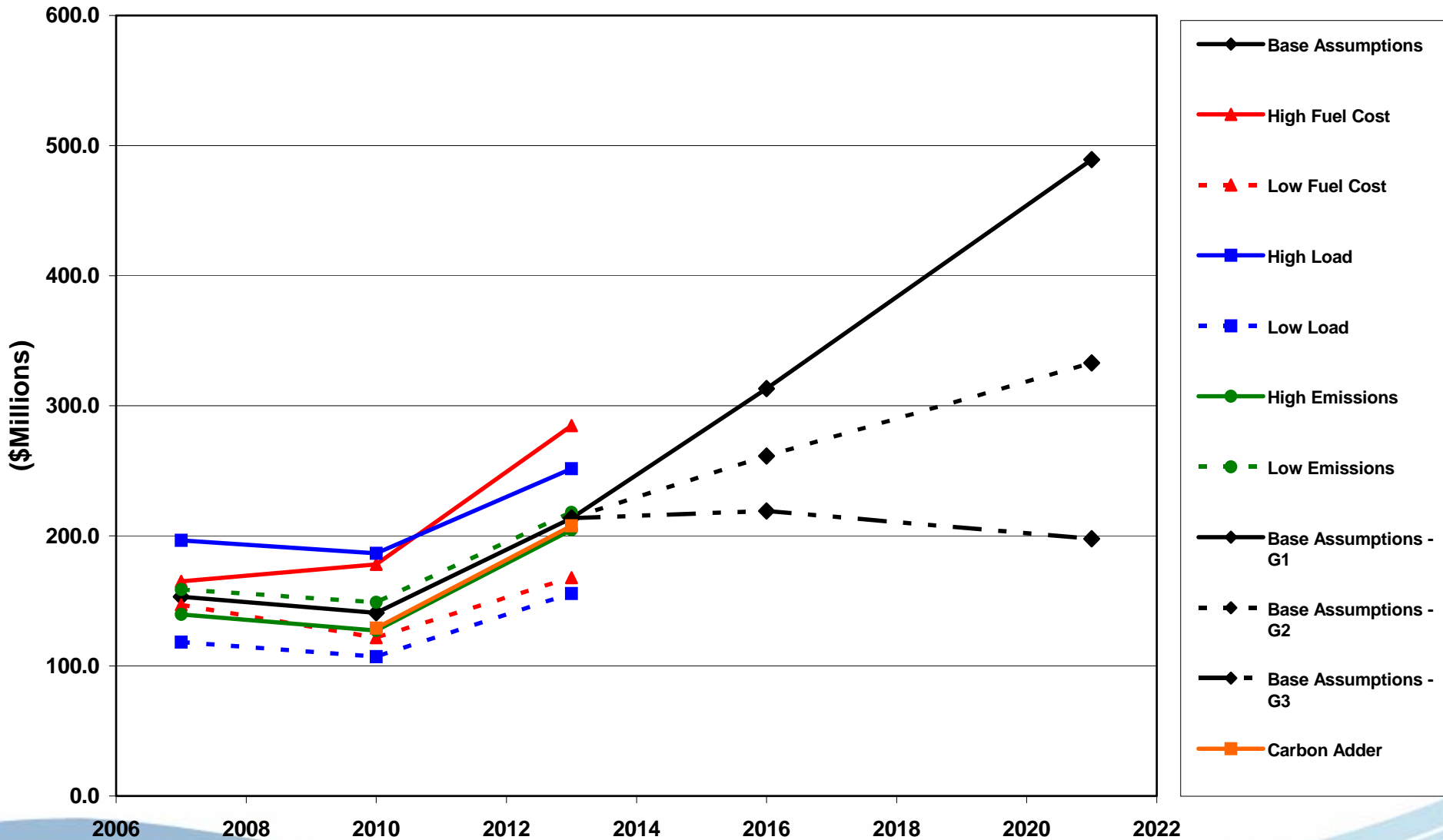
## Metrics:

- Total Production “cost”
  - Transmission Congestion Cost
  - Load Payments (energy)
  - Generation Revenue
  - Transmission Losses
  - Generation Capacity Payments

1. Economic metrics are not as definitive as reliability metrics
2. Provide Information to Market Stakeholders
3. Transparent Review of Results and Assumptions
4. Stakeholder Discussion
5. Recommendation to Board
6. Recommendation to FERC

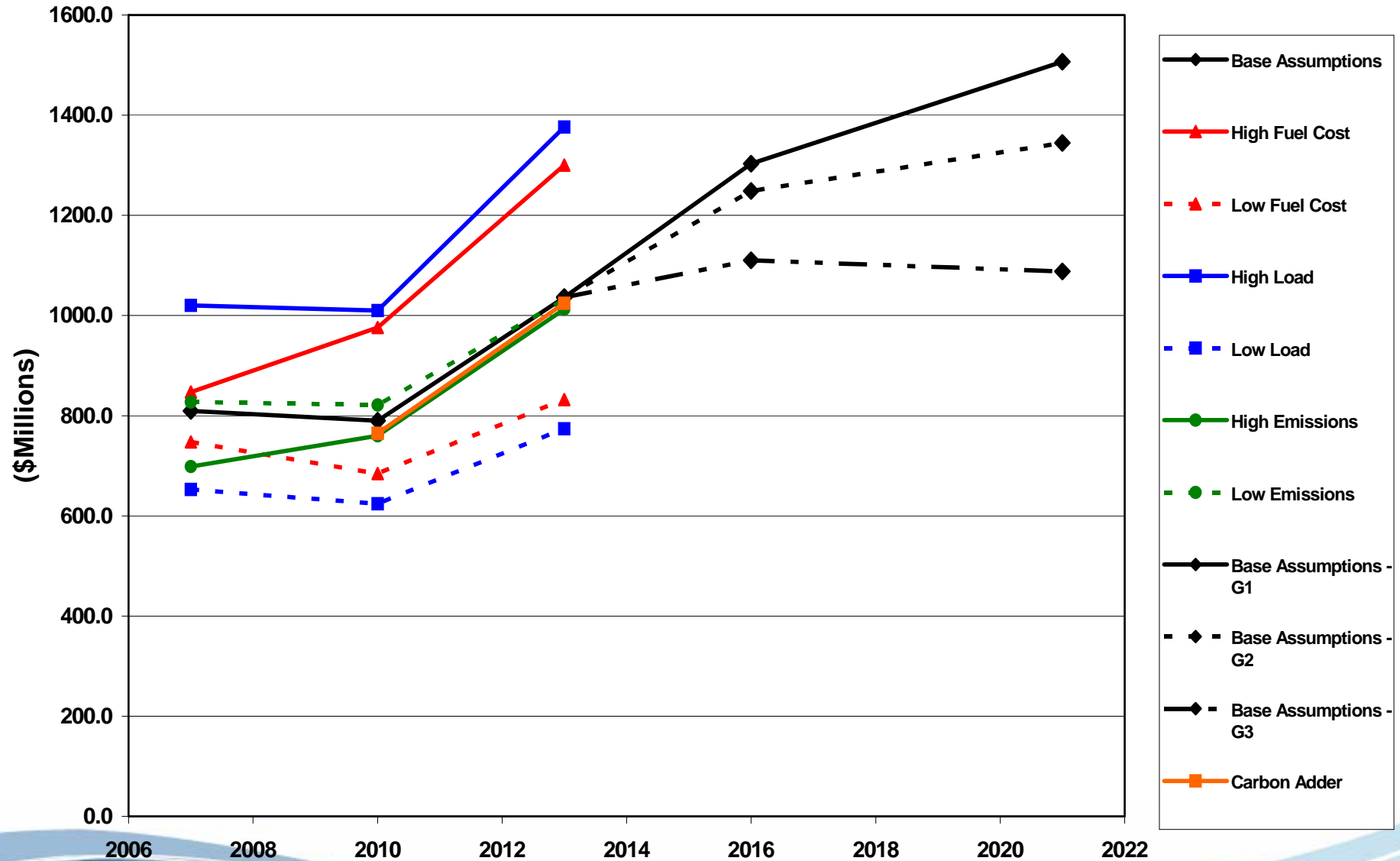


# System Production Cost Savings associated with 502 Junction-Meadowbrook-Loudoun 500 kV Line





# System Congestion Cost Savings associated with 502 Junction-Meadowbrook-Loudoun 500 kV Line





# Benefit NPV vs Cost NPV (Energy Market Benefits Only)

## PRODUCTION COST METRIC

	8% Discount Rate	10% Discount Rate	12% Discount Rate
30-year NPV Benefit	2,866.9	2,269.5	1,842.3
30-year NPV Cost	<u>(2,251.6)</u>	<u>(1,885.4)</u>	<u>(1,611.0)</u>
30-year Net Benefit	615.4	384.1	231.3
20-year NPV Benefit	2,210.7	1,855.0	1,577.6
20-year NPV Cost	<u>(1,963.6)</u>	<u>(1,702.7)</u>	<u>(1,493.9)</u>
20-year Net Benefit	247.1	152.3	83.7
10-year NPV Benefit	1,215.6	1,101.2	1,002.2
10-year NPV Cost	<u>(1,342.0)</u>	<u>(1,228.9)</u>	<u>(1,130.0)</u>
10-year Net Benefit	(126.4)	(127.7)	(127.8)

## CONGESTION COST METRIC

	8% Discount Rate	10% Discount Rate	12% Discount Rate
30-year NPV Benefit	13,386.2	10,732.9	8,818.9
30-year NPV Cost	<u>(2,251.6)</u>	<u>(1,885.4)</u>	<u>(1,611.0)</u>
30-year Net Benefit	11,134.6	8,847.5	7,207.8
20-year NPV Benefit	10,622.3	8,986.0	7,702.7
20-year NPV Cost	<u>(1,963.6)</u>	<u>(1,702.7)</u>	<u>(1,493.9)</u>
20-year Net Benefit	8,658.7	7,283.3	6,208.8
10-year NPV Benefit	6,188.8	5,623.8	5,133.3
10-year NPV Cost	<u>(1,342.0)</u>	<u>(1,228.9)</u>	<u>(1,130.0)</u>
10-year Net Benefit	4,846.8	4,394.9	4,003.3

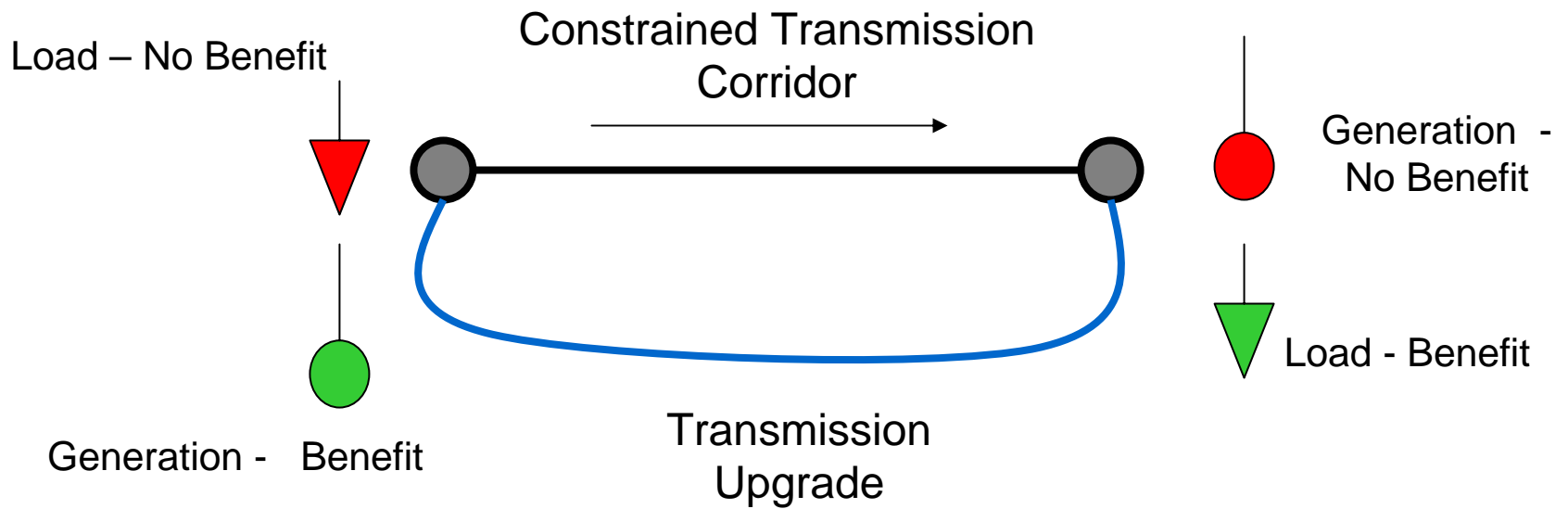
## LOAD PAYMENT METRIC

	8% Discount Rate	10% Discount Rate	12% Discount Rate
30-year NPV Benefit	19,306.0	14,858.8	11,731.3
30-year NPV Cost	<u>(2,251.6)</u>	<u>(1,885.4)</u>	<u>(1,611.0)</u>
30-year Net Benefit	17,054.5	12,973.4	10,120.3
20-year NPV Benefit	13,938.8	11,471.6	9,570.3
20-year NPV Cost	<u>(1,963.6)</u>	<u>(1,702.7)</u>	<u>(1,493.9)</u>
20-year Net Benefit	11,975.1	9,768.9	8,076.4
10-year NPV Benefit	6,562.5	5,896.2	5,323.5
10-year NPV Cost	<u>(1,342.0)</u>	<u>(1,228.9)</u>	<u>(1,130.0)</u>
10-year Net Benefit	5,220.5	4,667.3	4,193.4

## GENERATION REVENUE METRIC

	8% Discount Rate	10% Discount Rate	12% Discount Rate
30-year NPV Benefit	5,919.8	4,125.8	2,912.4
30-year NPV Cost	<u>(2,251.6)</u>	<u>(1,885.4)</u>	<u>(1,611.0)</u>
30-year Net Benefit	3,668.2	2,240.4	1,301.4
20-year NPV Benefit	3,316.4	2,485.6	1,867.7
20-year NPV Cost	<u>(1,963.6)</u>	<u>(1,702.7)</u>	<u>(1,493.9)</u>
20-year Net Benefit	1,352.8	782.9	373.8
10-year NPV Benefit	373.6	272.4	190.1
10-year NPV Cost	<u>(1,342.0)</u>	<u>(1,228.9)</u>	<u>(1,130.0)</u>
10-year Net Benefit	(968.4)	(956.5)	(939.9)

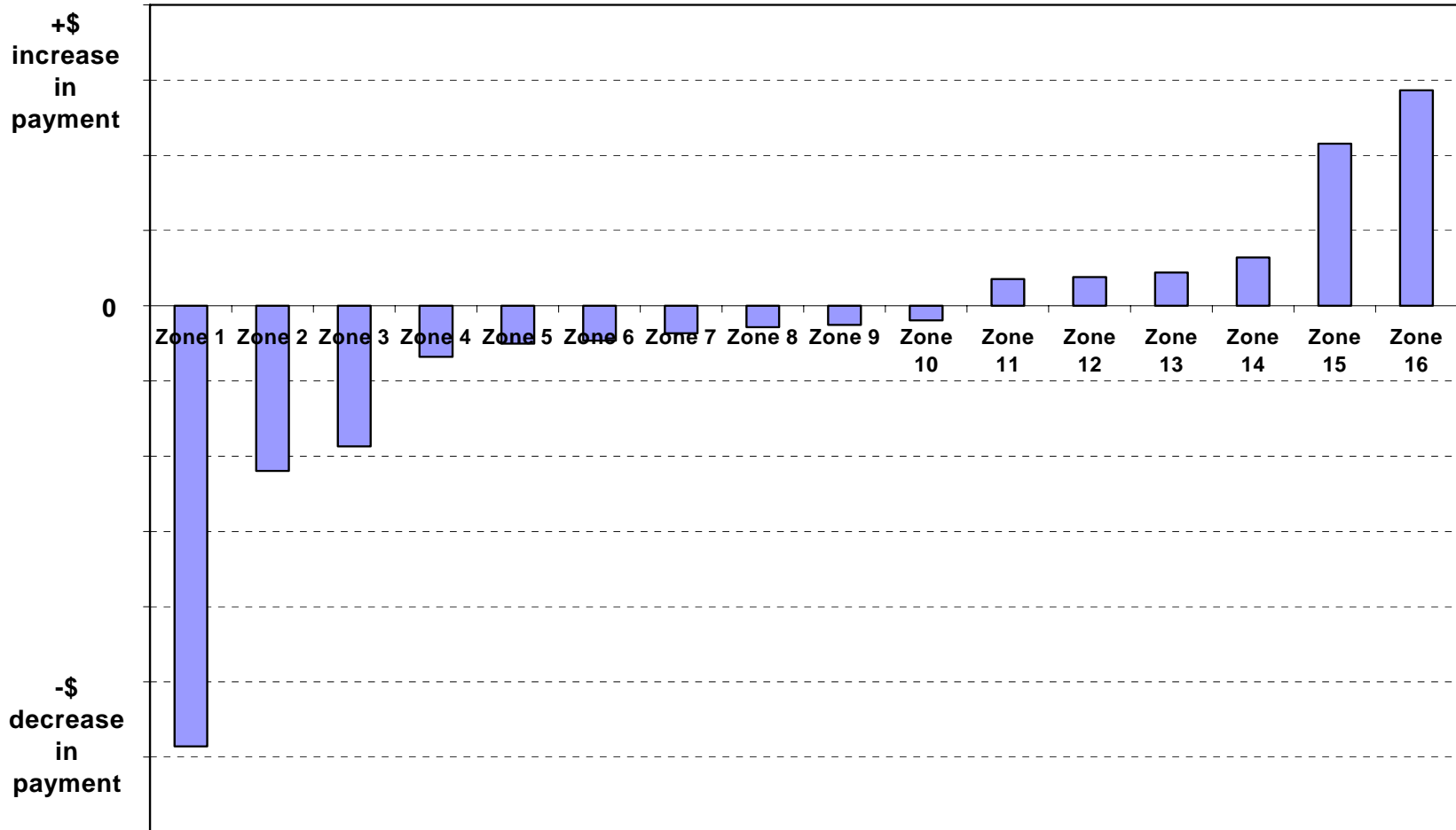
Relative benefit depends on location





- Market simulation made using GE MAPS model
- Simulation of hourly security-constrained generation dispatch over an annual period
- Simulations made with and without an actual Transmission upgrade
- Cost of Transmission upgrade allocated based on zonal power distribution factor for load beneficiaries
- Change in Load Payments compared to cost allocation

## Change in Zonal Load Payment due to RTEP Upgrade

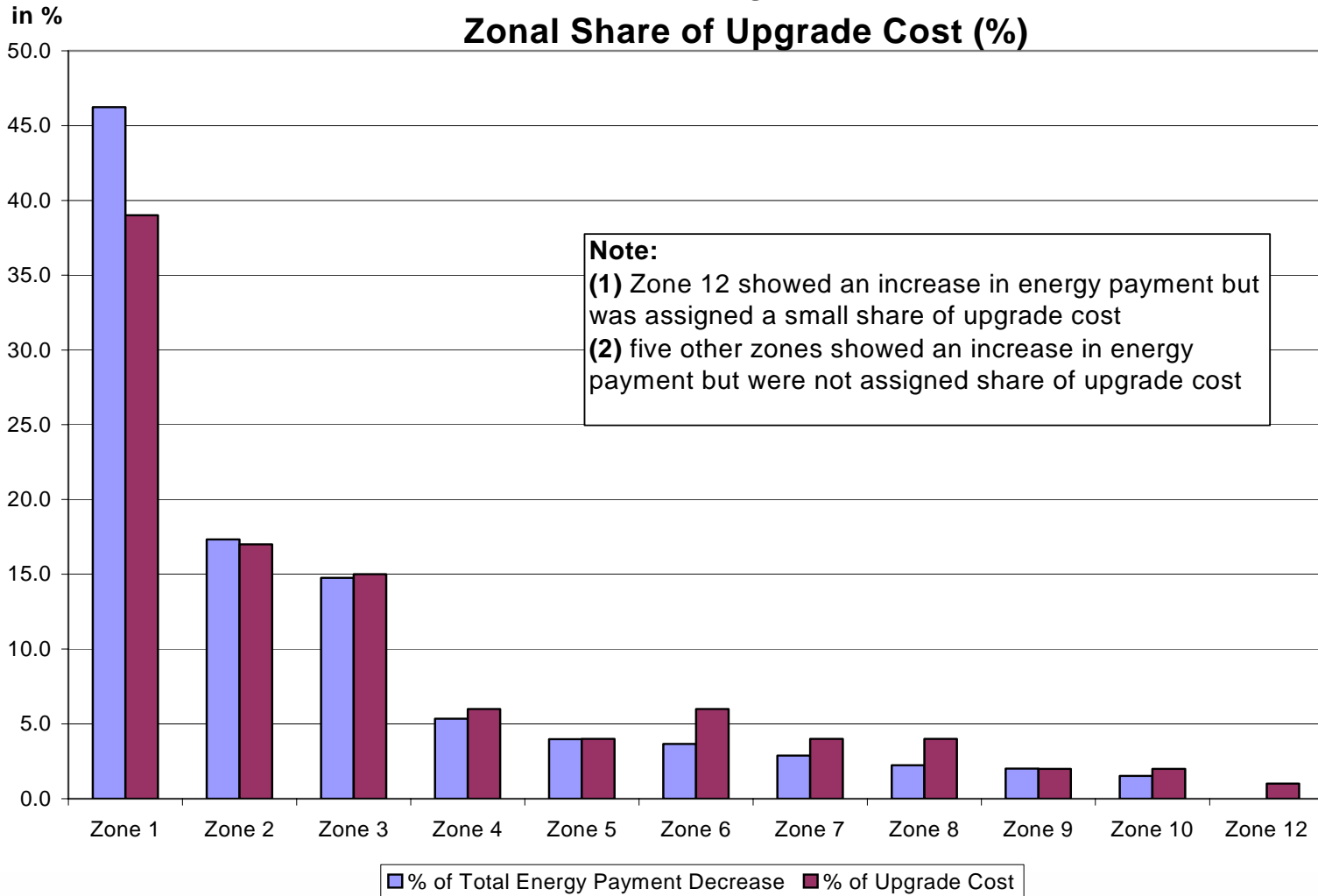


# Simulation Results (cont.)

Zonal Share of Total Savings (%)

VS

Zonal Share of Upgrade Cost (%)



- Difficult to justify large scale upgrades based solely on economic benefits
- Economic metric will evolve as validation and/or reason to advance reliability upgrades
- PJM economic expansion metric likely reduces merchant incentives
- Incremental Rights created by upgrades should be allocated to customers or zones in proportion to cost allocation