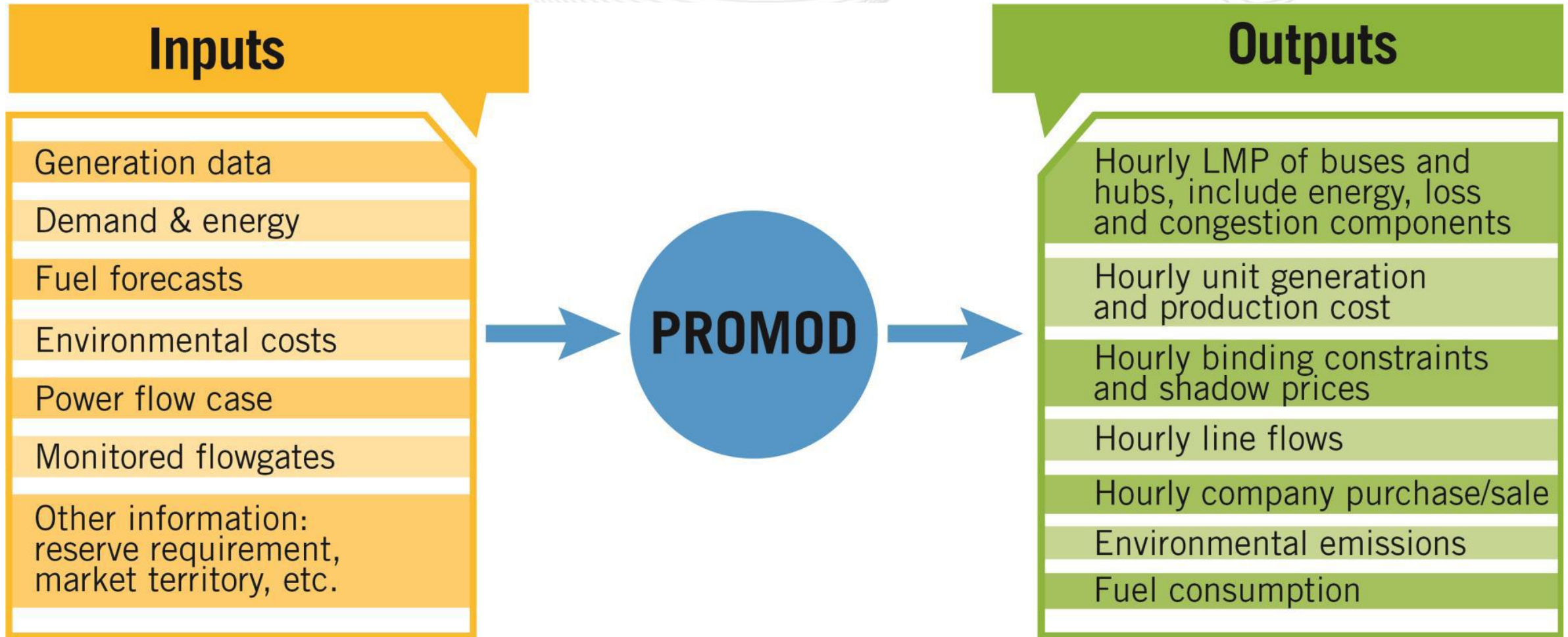


PJM Market Efficiency Benefits Calculation

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- Market Efficiency Projects may address:
 - Energy market constraints (drivers)
 - Capacity market constraints (drivers)
- Market Efficiency Projects may generate:
 - Energy market benefits
 - Capacity market benefits (RPM Benefits)
- Total Benefits = Energy Benefits + RPM Benefits



- Regional Projects: 50% Change in Total Energy Production Cost + 50% Change in Load Energy Payment
- Lower Voltage Projects: 100% change in Load Energy Payment

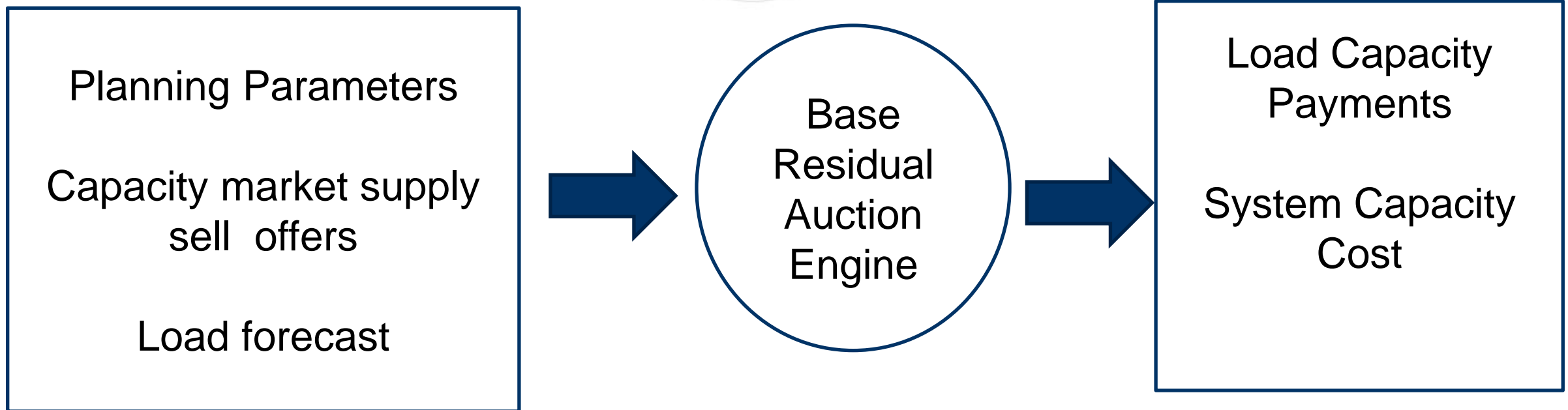
* Only zones with decrease in net load payments

- Change in Total Energy Production Cost
 - Calculated for the PJM Region
 - Adjusted for interchange with neighboring pools
- Change in Load Energy Payments
 - Calculated for each transmission zone
 - Only zones that show a LMP decrease will be considered

Item	Production Cost Benefits	Load Payment Benefits
Granularity	PJM region	Benefitting Transmission Zones
Simulated years	Four years (RTEP - 4, RTEP, RTEP+3, RTEP+6)	
Trend	Interpolated between the simulated years & Extrapolated after the last simulated years	
Benefits horizon	Calculated for the period starting with the project in-service date and capped at 15 years from the RTEP year. (Net Present Value)	

- Fuel and load forecasts driving uncertainties in the benefits calculation for the 4th simulated year and trending beyond.
- Benefits metric is more strict for regional projects than for lower voltage projects

PJM Market Efficiency Benefits Calculation - Capacity



- Regional Projects: 50% Change in System Capacity Cost + 50% Change in Load Capacity Payment
- Lower Voltage Projects: 100% change in Load Capacity Payment

* Only zones with decrease in net load payments

- Change in Total System Capacity Cost
 - Calculated for the PJM Region

- Change in Load Capacity Payment
 - Calculated for each transmission zone
 - Only zones that show a LMP decrease in capacity payment will be considered

Item	Capacity Cost Benefits	Load Capacity Payment Benefits
Granularity	PJM region	Benefitting Transmission Zones
Simulated years	Three years (RTEP, RTEP+3, RTEP+6)	
Trend	Interpolated between the simulated years & Extrapolated after the last simulated years	
Benefits horizon	Calculated for the period starting with the project in-service date and capped at 15 years from the RTEP year. (Net Present Value)	

- Planning parameters applicable for capacity market driver cannot be calculated beyond RTEP year
- Capacity market benefits are calculated assuming most recent capacity market offers
- Reproducing CETL calculations are difficult, as PJM does not post the list of LDA constraints behind the first binding constraints
- Model inputs not available: market sensitive bids are not shared by PJM
- BRA software is not available to participants

Appendix A - Glossary

- Calculated as total annual fuel costs, variable O&M costs, and emissions costs of the dispatched resources in the PJM Region, adjusted for the interchange with the neighboring pools
 - Purchases valued at the Load Weighted LMP
 - Sales valued at the Generation Weighted LMP

$$\begin{aligned}
 APC &= \sum_{Units}^{Base\ Case} \left[(Fuel\ Costs + Emission\ Costs + Variable\ O\&M) \right. \\
 &\quad \left. + \left(\begin{array}{l} PJM\ Purchase \times PJM\ Load\ Weighted\ LMP \\ -PJM\ Sale \times PJM\ Gen\ Weighted\ LMP \end{array} \right) \right]
 \end{aligned}$$

- Calculated as the annual sum of the hourly estimated zonal load megawatts for each PJM transmission zone multiplied by the hourly estimated zonal Locational Marginal Price for each PJM transmission zone minus the value of Transmission Rights for each PJM transmission zone.

$$\begin{aligned}
 NLP = & \sum_{Hours} \sum_{Zones} (Hourly\ Bus\ Load \times Hourly\ Bus\ LMP) \\
 & - 8760 \times \sum_{Zones} ARR\ Patch\ Cleared\ MW \times (Annual\ Sink\ Node\ CLMP \\
 & \quad \times Annual\ Source\ Node\ CLMP)
 \end{aligned}$$

- **Change in Total Adjusted Energy Production Cost**
 - Calculated as difference in total Adjusted Production Costs without and with the enhancement or expansion.

- **Change in Load Energy Payment**
 - Calculated as difference between the Net Load Payments without and with the economic-based enhancement or expansion.
 - Only zones that show a decrease will be considered in determining the Change in Load Energy Payments.

- **Change in Total System Capacity Cost**
 - Calculated as the difference between the sum of the megawatts that are estimated to be cleared in the Base Residual Auction under PJM's Reliability Pricing Model capacity construct times the prices that are estimated to be contained in the offers for each such cleared megawatt (times the number of days in the study year) without and with the economic-based enhancement or expansion.
- **Change in Load Capacity Payment**
 - Calculated as the sum of the estimated zonal load megawatts in each PJM transmission zone times the estimated Final Zonal Capacity Prices (payments paid by load in each transmission zone) for capacity under the Reliability Pricing Model construct (times the number of days in the study year) minus the value of Capacity Transfer Rights for each PJM transmission zone without and with the economic-based enhancement or expansion.
 - Only PJM transmission zones that show a decrease will be considered in determining the Change in Load Capacity Payment.