Con Edison and Orange and Rockland Utilities'

Marginal Cost of Service Studies

June 28, 2019

Background and methodology

The Company partnered with the Brattle Group to develop locational Marginal Cost-based Cost of Service Study approach for Con Edison in response to the Commission's Rate Order in Case 16-E-0060

- The study covers a 10 year period and spans the entire service territory
- The Company and Brattle have conducted several presentations to Rate Case parties and VDER stakeholders
- Orange and Rockland subsequently conducted an MCOS study for its New York State service territory using the same approach
- The studies were filed in the DSIP and MCOS proceedings

Key points of the Study

- Marginal costs (MCs) are calculated at the network/load area level for five cost centers
- The study enabled groupings of load area MCs for identification of areas of higher value
- There is high variability in the MCs, both locational and temporal
  - Reflective of varying levels of load growth and system needs

Study description

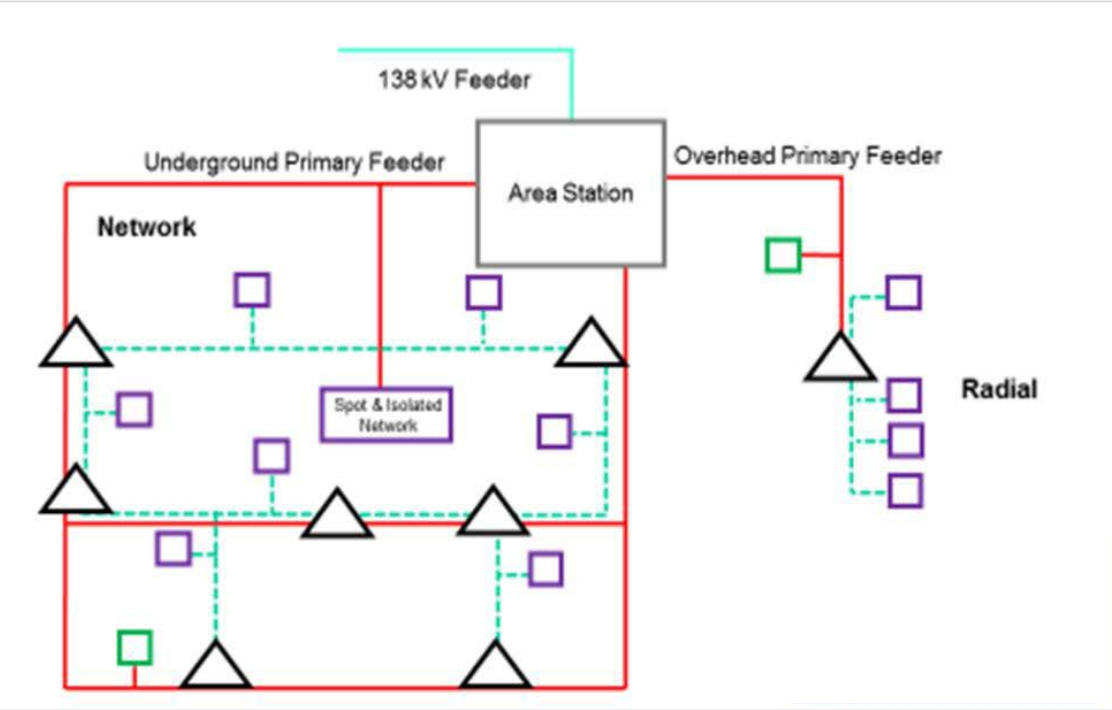
- Based on marginal costs due to incremental load growth and utilizing utility planning criteria (traditional wires-option solutions)
- Provides a baseline for comparison to non-wires solutions
- Results can be used to support variety of efforts (e.g., Benefit Cost Analyses, Value of DER, and designing rates for economic development programs)

Cost Centers

1. **High Voltage System Costs**
2. **Area Station and Sub-transmission**
3. **Primary Feeder Costs**
4. **Distribution Transformer Costs**
5. **Secondary Cable Costs**

High tension customer

Low tension customer



High Voltage System costs are allocated to load areas

Calculating the Marginal Cost

$$\textbf{Marginal Cost (\$/kW)} = \frac{\text{NPV (Net Cost)}}{\text{NPV (Capacity Increase)}}$$

Cost center	Cost source	Investment timing
High Voltage	10-yr Transmission Long-Range Plan	In-service dates according to Long-Range Plans
Area Station & Sub-transmission	10-yr Area Station Load Relief Program	
Primary	2015 - 2017 historical samples of load relief capex	Feeder load grows with network; investments occur when overloaded
Distribution Transformer		Frequency: timing to load growth correlated to historical occurrences
Secondary		

What is the cost?

- *$ per kW*

Where is it needed?

- *Spatially across the territory*
- *Cost center*

When is it needed?

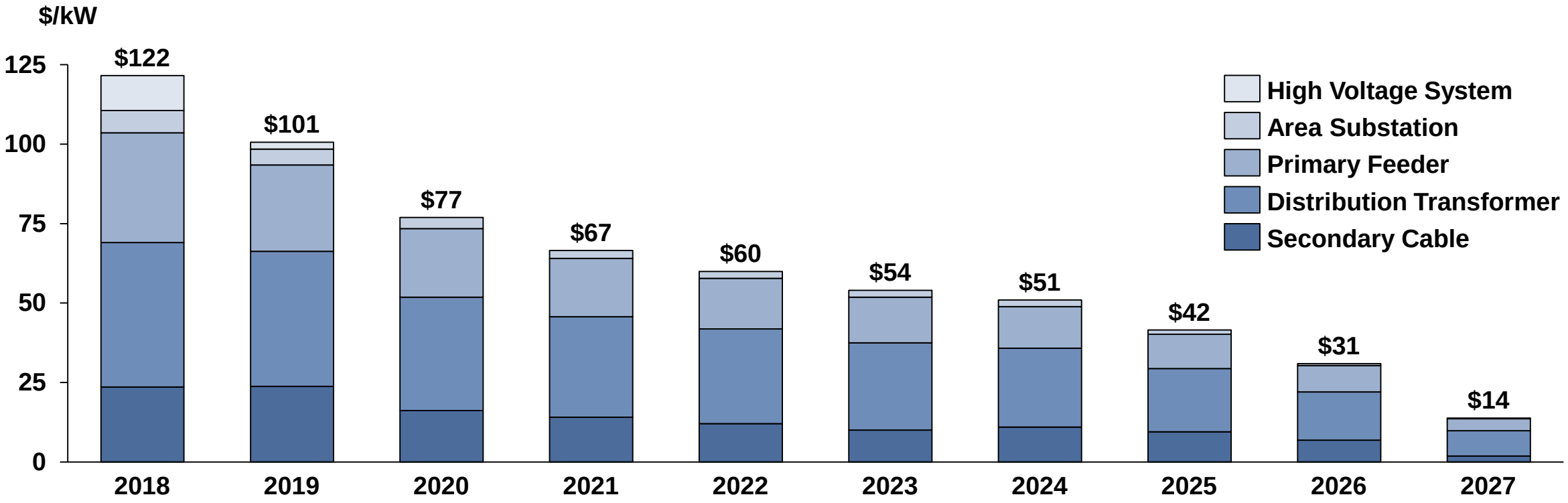
- *Across planning horizon*
- *Temporally, during peak day*

Investment Timing

- **High Voltage and Area Station**
  - In-service dates based on 10-year planning scenario
  - Upgrades occur when load growth exceeds normal design ratings
- **Primary Feeders**
  - Loading of each feeder is assumed to grow at the load growth rate of its corresponding Network/Load Area
  - Upgrade needs occur when the feeder loading exceeds its design rating
- **Transformer and Secondary**
  - Frequency of upgrades based on historically observed counts of upgrades, correlated to network load growth

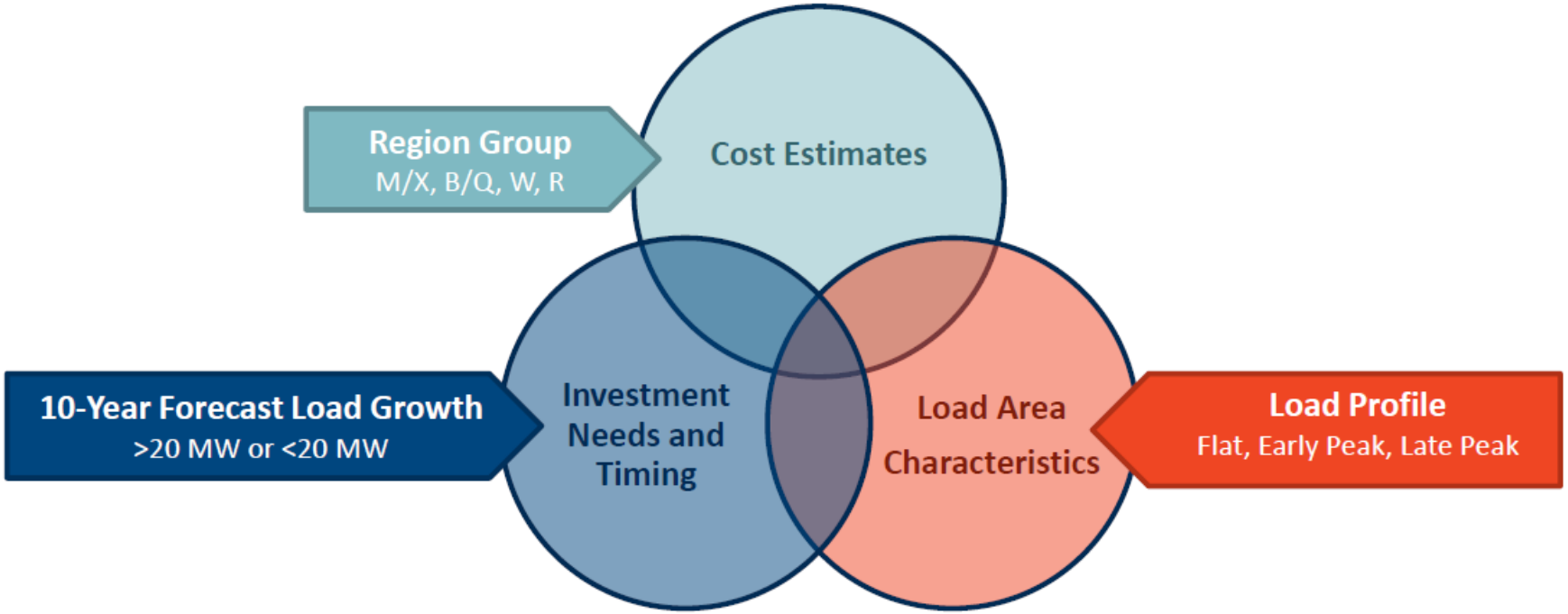
Con Edison Marginal Costs by Cost Center

Primary Feeder, Distribution Transformer, and Secondary Cable cost centers compose majority of average total marginal costs.



Load Area Grouping by Marginal Cost

Segmenting the Load Area MCs in clusters for **project costs**, **project timing**, and **load area characteristics** allow for grouping similar areas together.



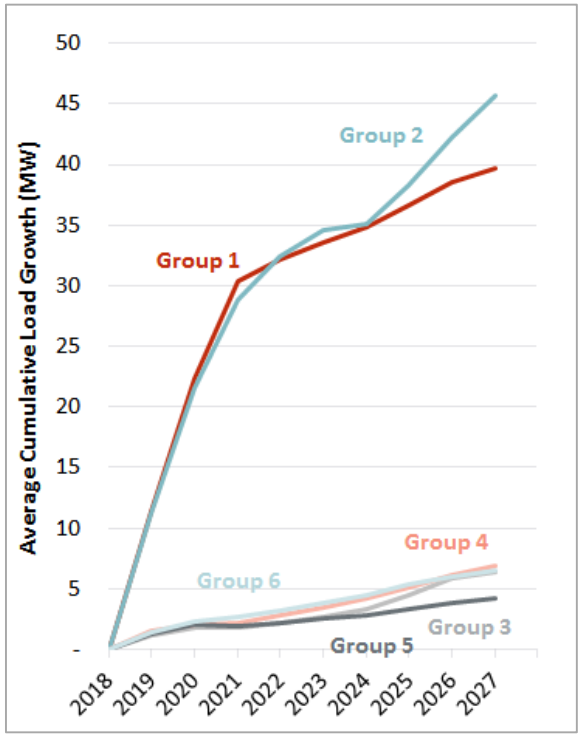
Drivers for Load Area Grouping

Cost Estimates

Region-groups serve as a proxy for project costs, reflecting the effects of (1) urban vs. suburban areas, and (2) networked vs. radial systems

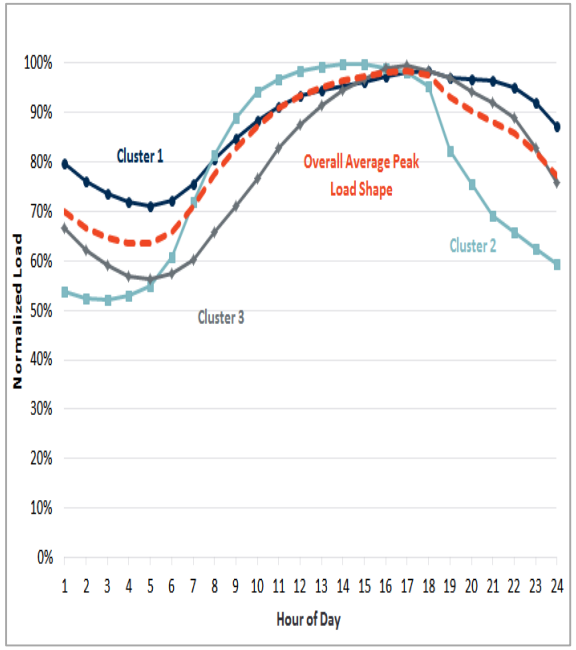
Investment Needs and Timing

Ten-year cumulative load growth forecast serves to identify future investment needs and timing.

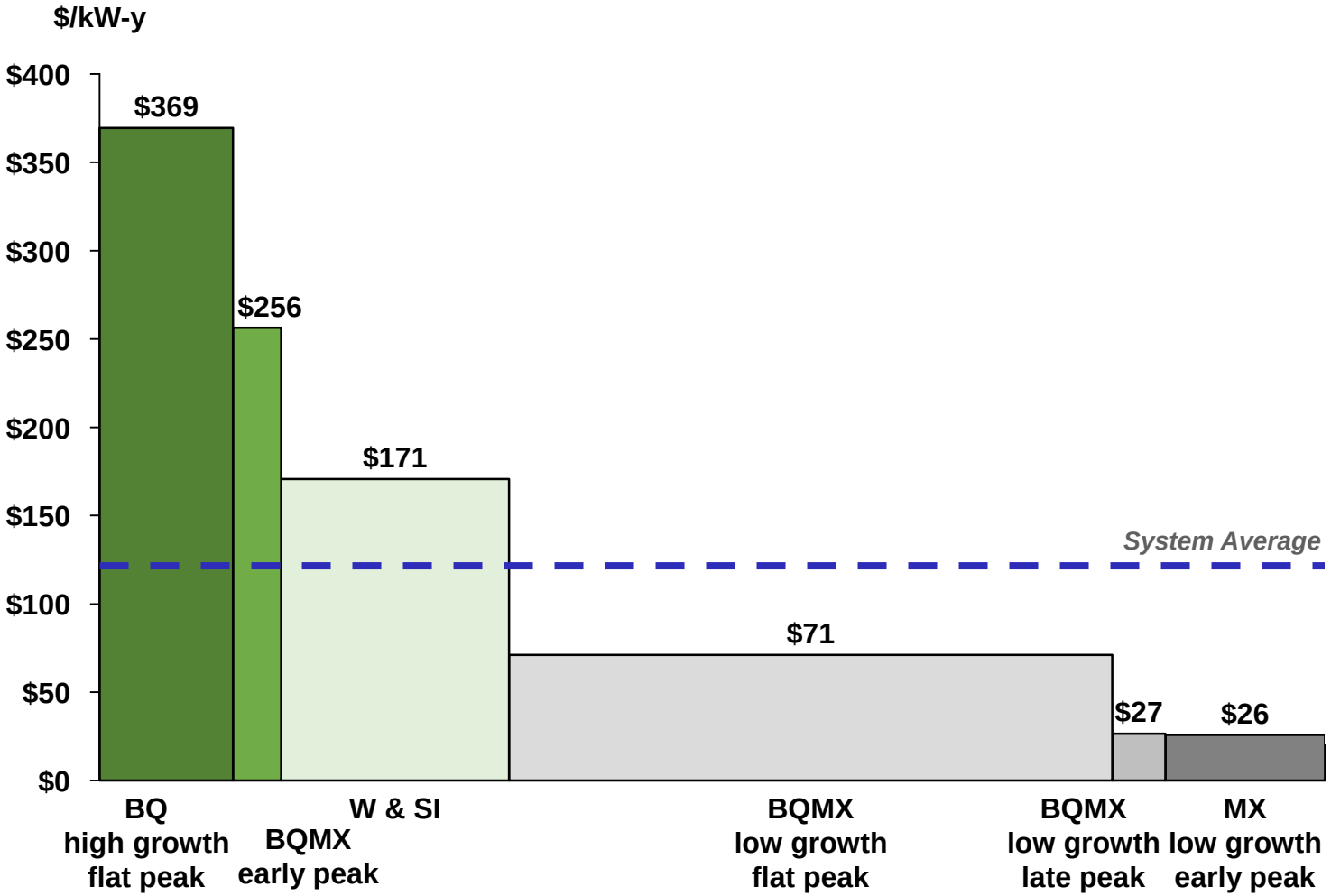


Load Area Characteristics

The 24-hour normalized load profile of each Load Area is assigned to one of three general load shapes using statistical k-means clustering. Load shapes serve as a proxy for the characteristics which are driving the investments

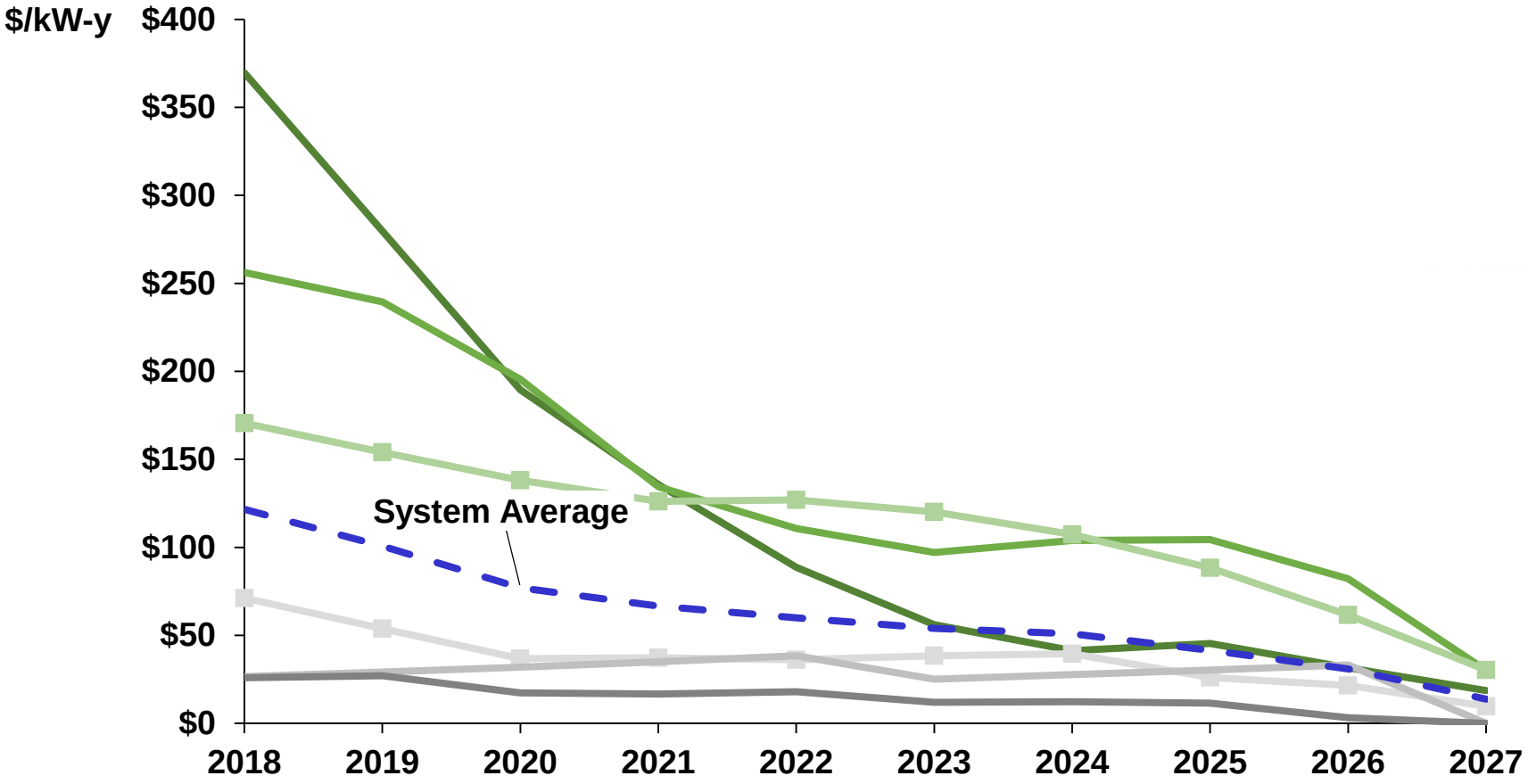


2018 CECONY Marginal Costs by load areas groups



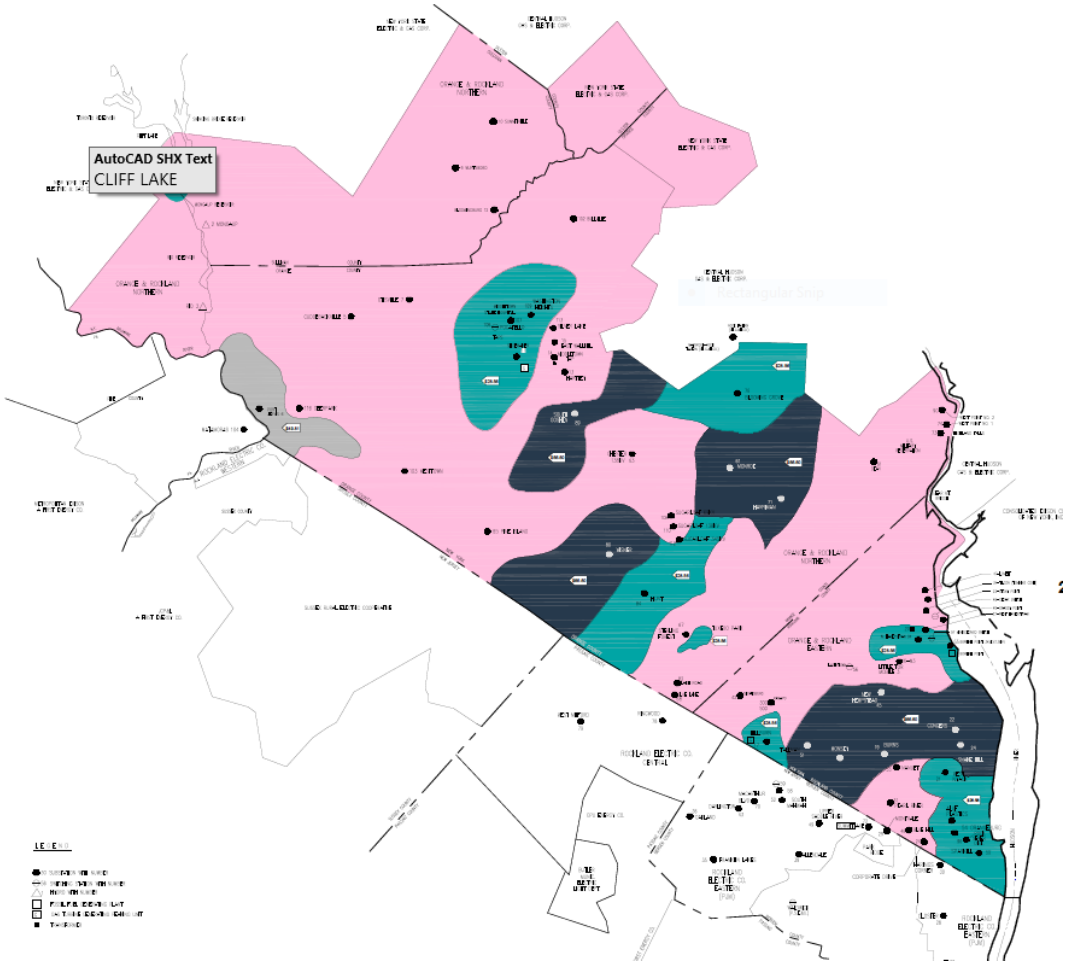
B = Brooklyn
Q = Queens
M = Manhattan
X = Bron**x**
SI = Staten **I**sland
W = Westchester

Over time, marginal costs decline as near-term system expansion projects go in service

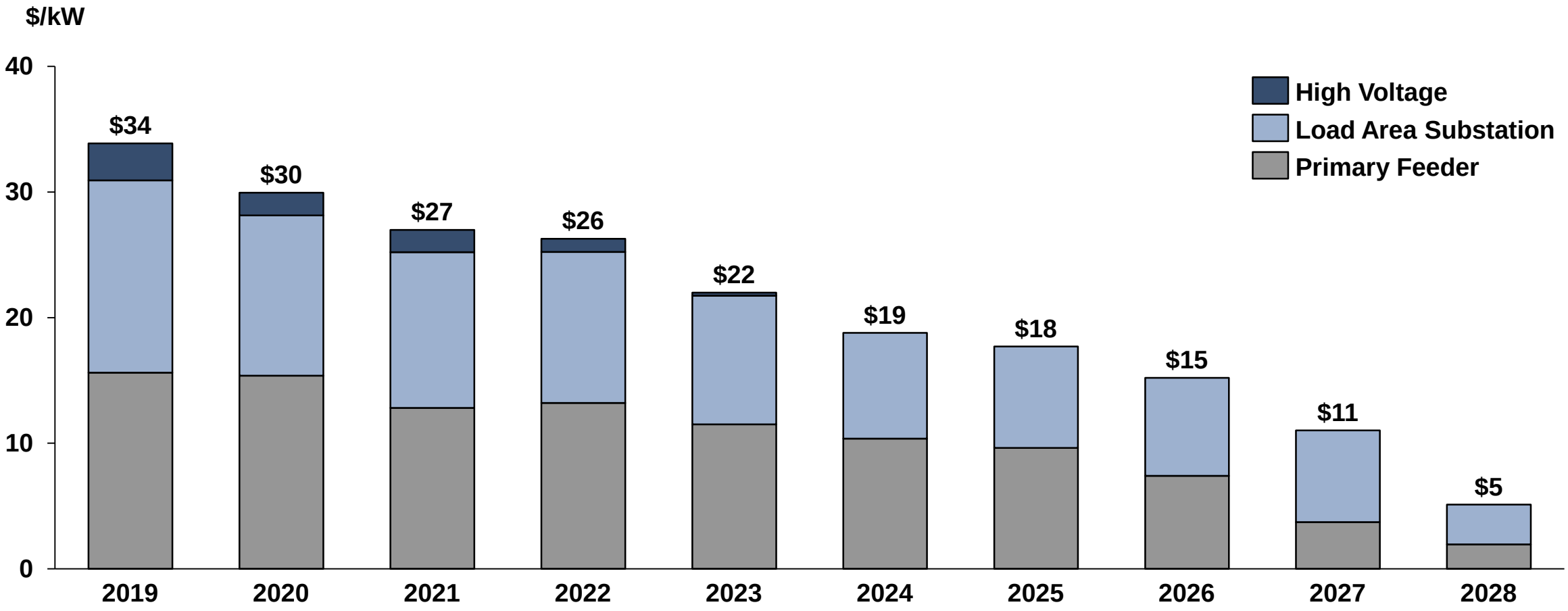


O&R study

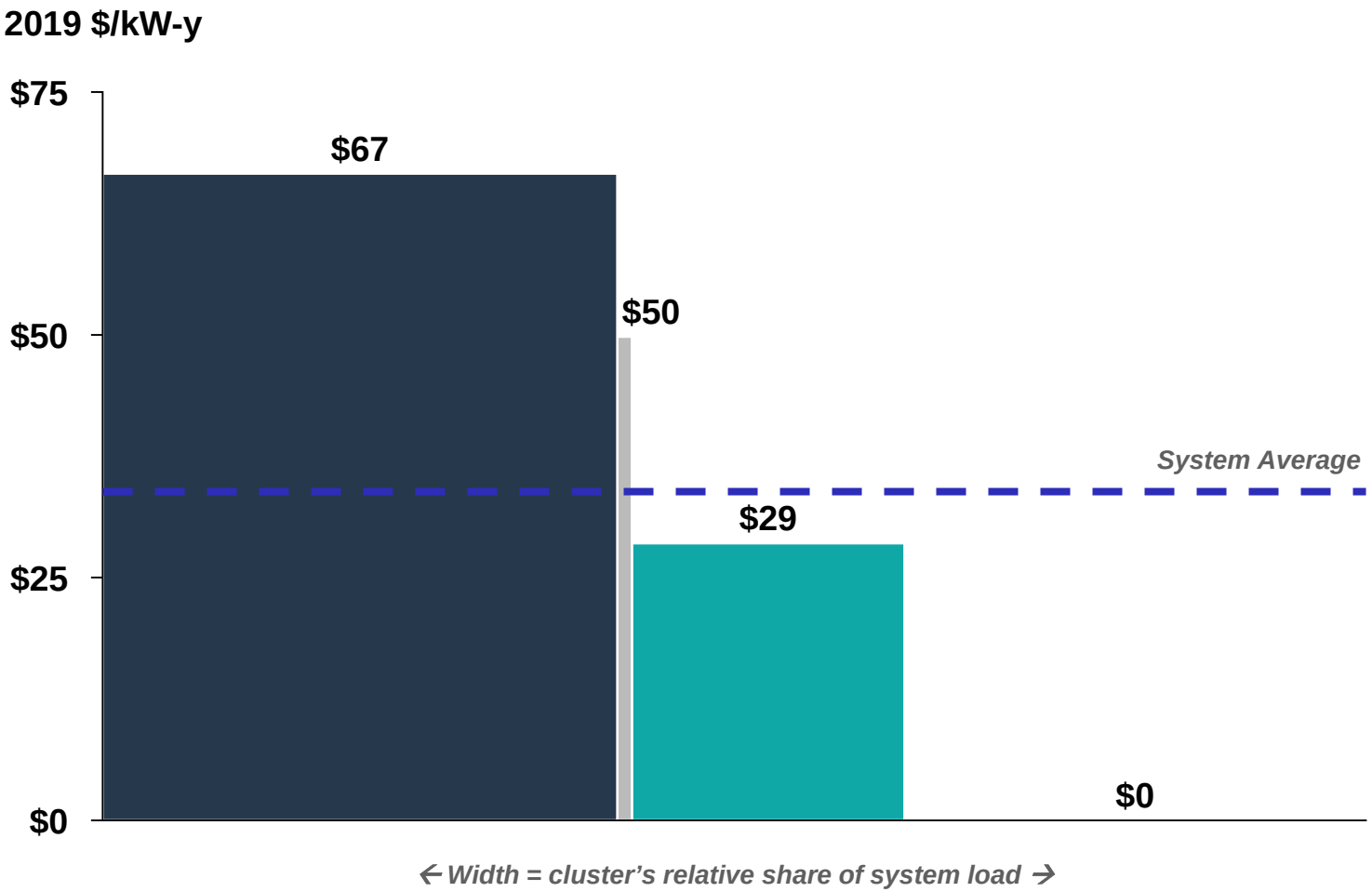
- Methodology to calculate load area and system-average MCs consistent with methodology used for CECONY radial system

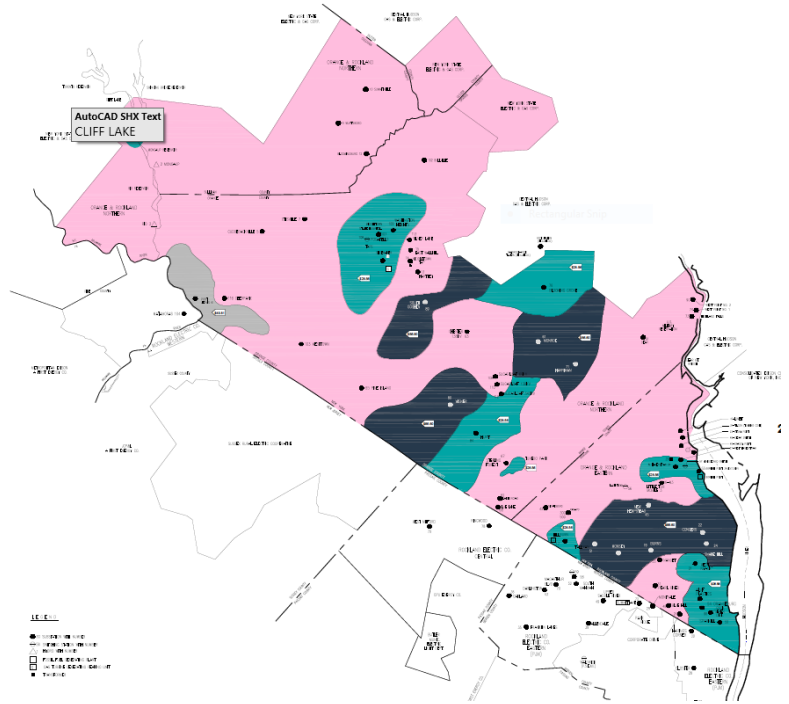


O&R System Average Marginal Costs by Cost Center



2019 O&R Marginal Costs by load areas groups





O&R marginal costs by year reflect load growth and system planning needs