

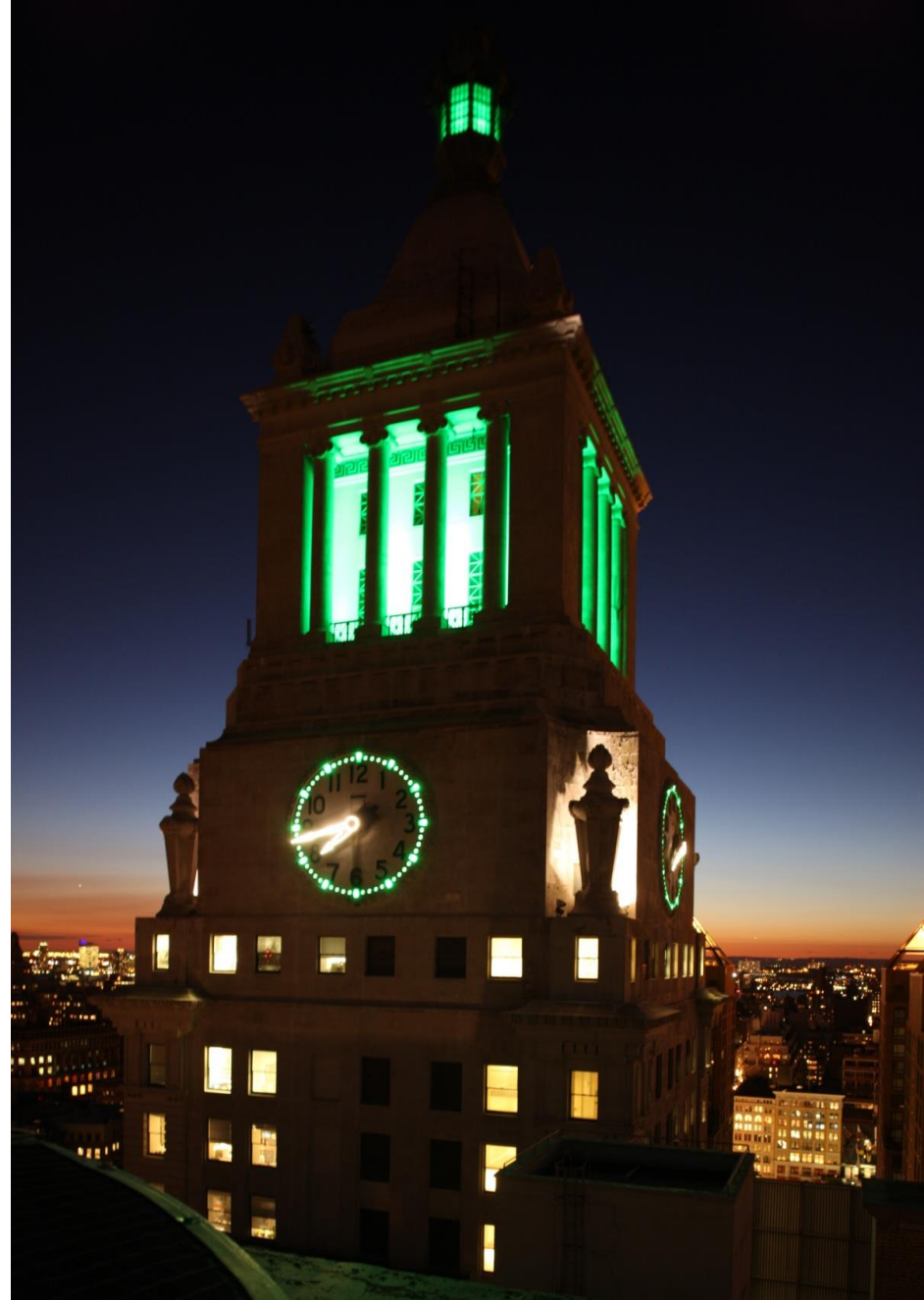
Con Edison's Integrated Demand Side Management Potential Model

**ACEEE National
Conference on Energy
Efficiency as a Resource**

Michael Harrington

**Energy Efficiency and Demand
Management**

Con Edison



Con Edison Background

What you know



What you may not

Con Edison Footprint

- » 660 square miles
- » 133,000 miles of T&D cable
- » 6+ million room A/C units

Customers

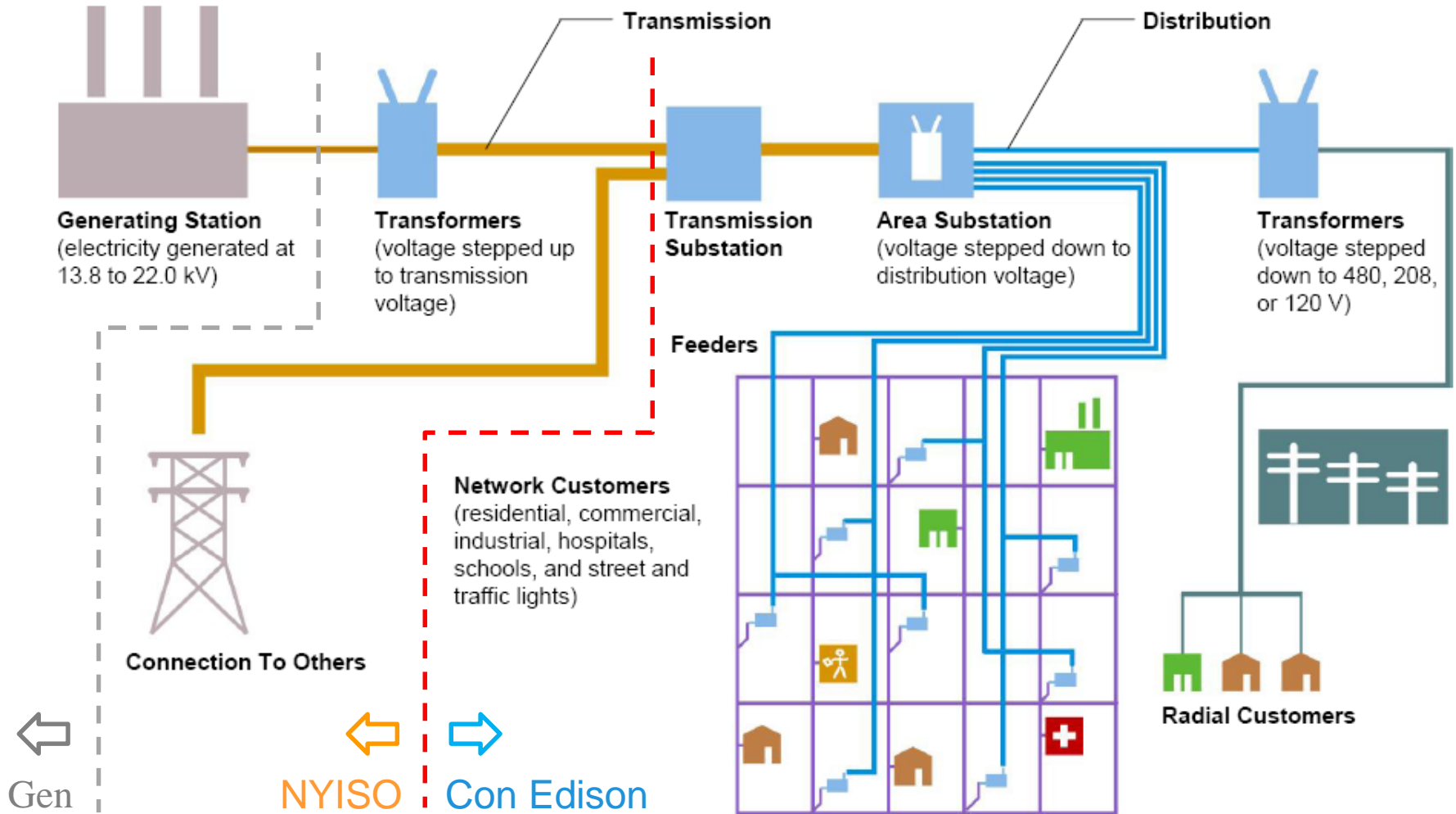
- » Population / square mile: 13,825 – **70,000**
- » 3.3m electric, 1.1m gas accounts, ~9m ppl served

Consumption

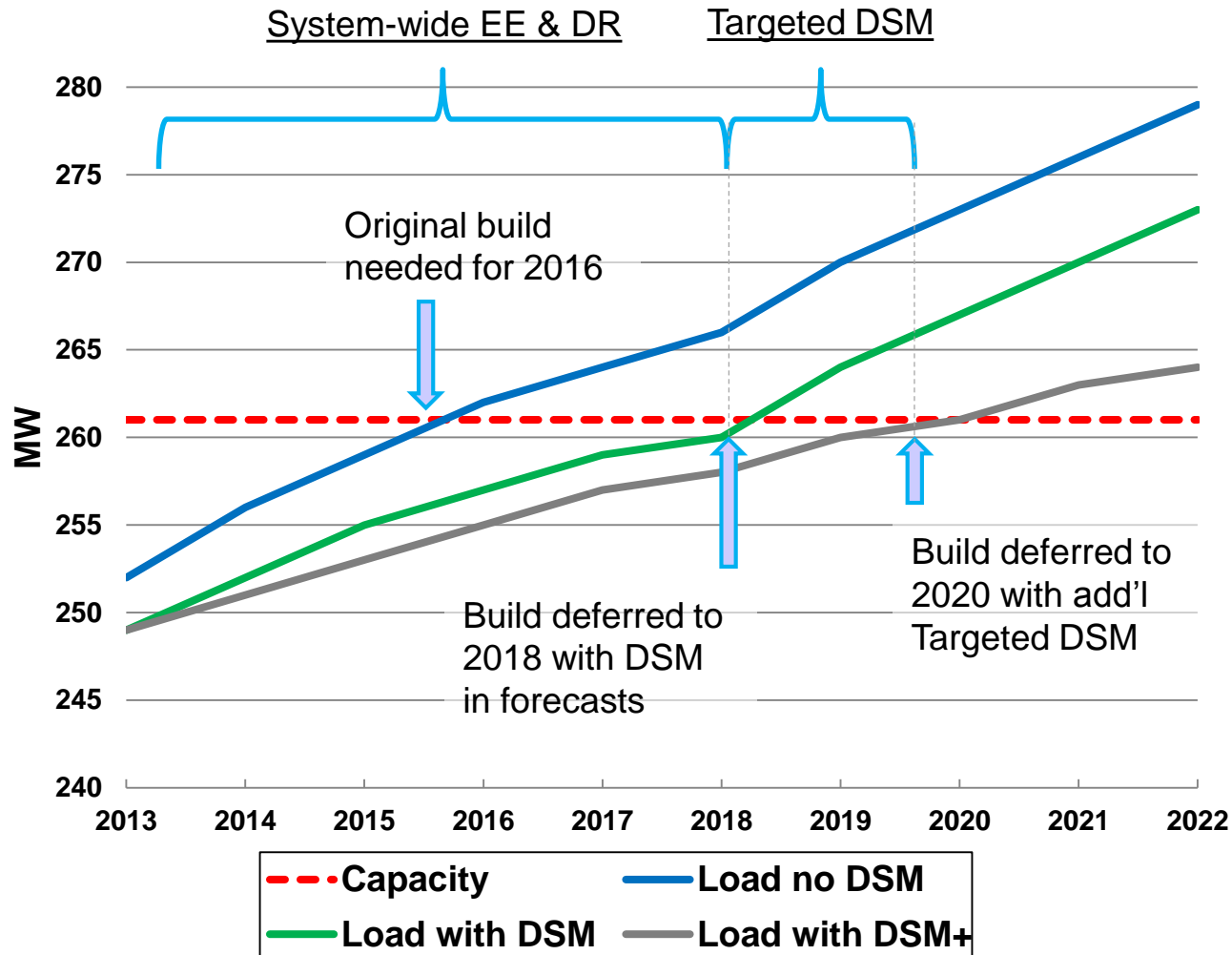
- » MW / square mile: 20 – **2,000**
- » 57 billion kWh annually
- » > 13,000 MW peak demand



NYS Electric System - Restructured



Infrastructure build deferrals via system-wide EE/DR programs and targeted DSM

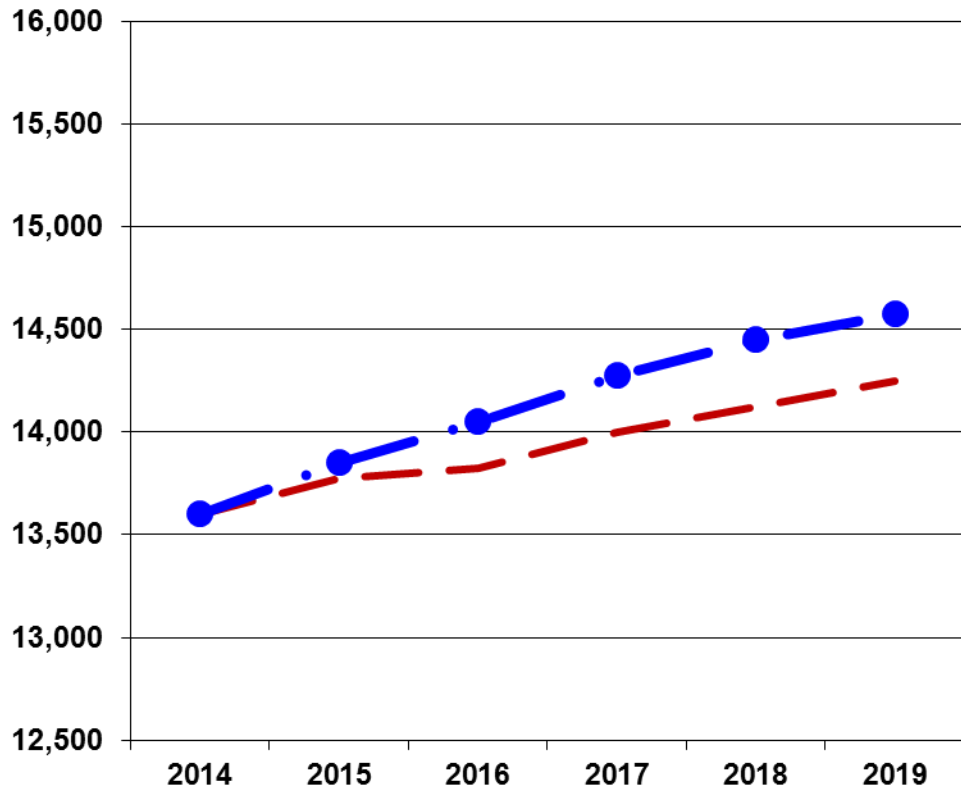


» Forecast with EE and DSM resources to reduce system costs

» Include in engineering, system planning

» Target programs to increase value and address gaps

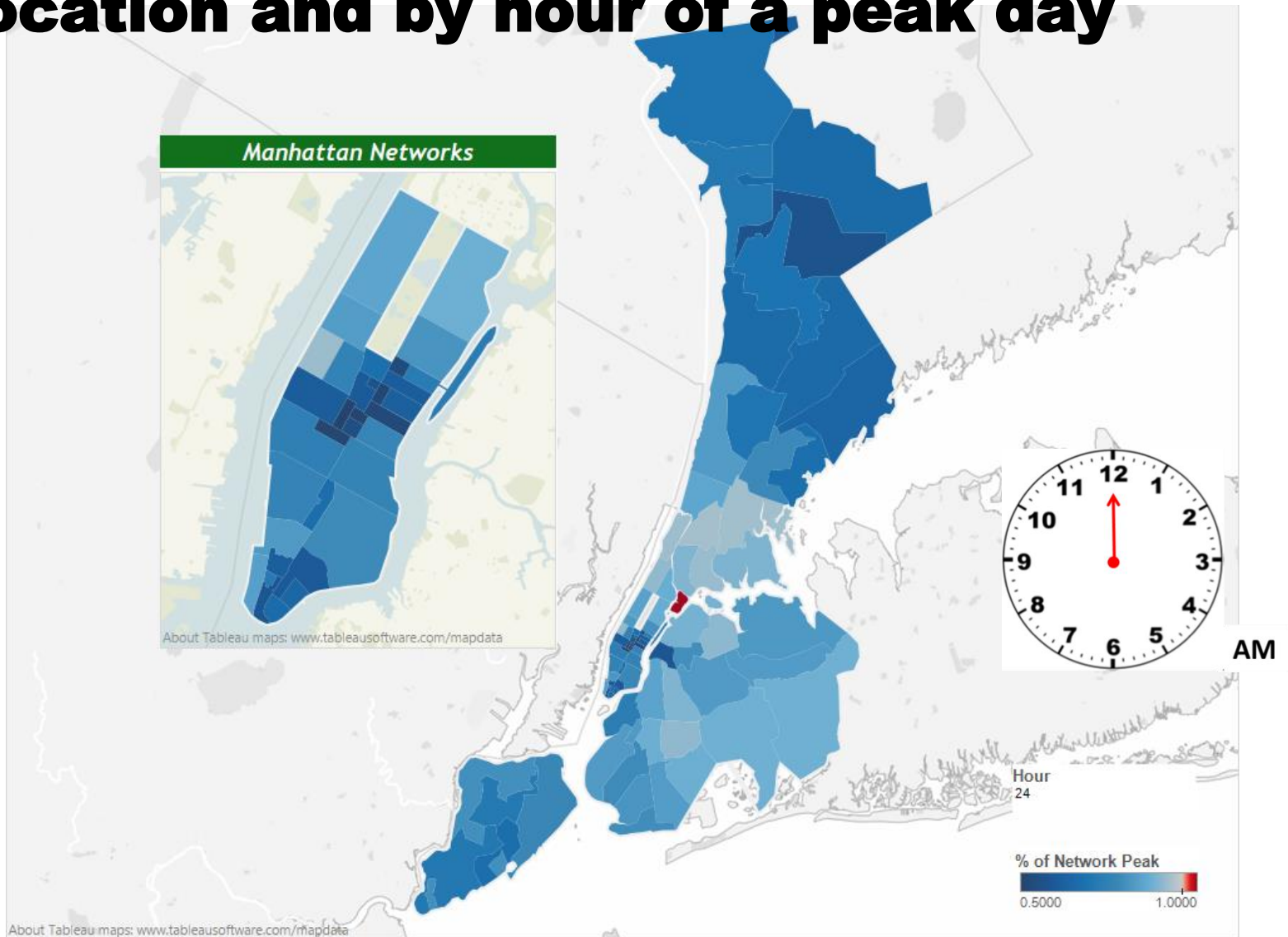
EE & Targeted DSM: A Measurable Impact on Demand



Including DSM in the forecast reduces peak demand growth by 35% over next 5 years

— September 2014 Forecast w/ DSM —●— September 2014 Forecast w/o DSM

Challenge: 82 network loads vary by location and by hour of a peak day

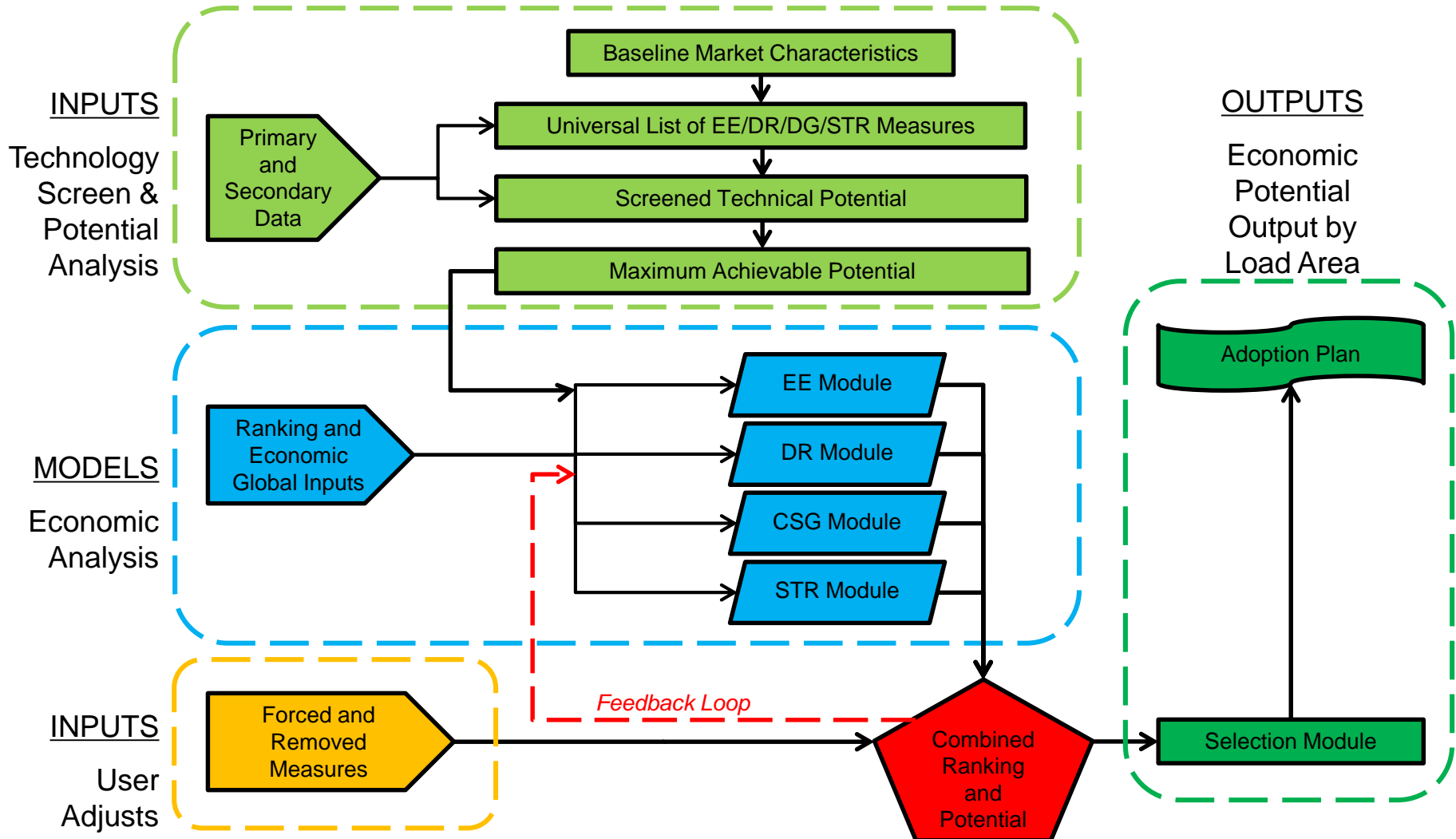


How much, where, and when could EE and DSM be targeted for infrastructure deferrals?



Integrated Demand Side Management Potential Model

Integrated Demand Side Management model evaluates potential and economics



IDSMS Potential Model Highlights

- Holistic DSM analysis – EE, DR, DG, ST
- Includes capital plan needs and costs (and benefits)
- Scalable and updatable
- Highly flexible (77 input levers) for scenarios
- Results by technology
- Results by measure
- Results by market segment
- Results by network, network groups, borough, & system

DSM Technology Screening

- 1) Technical Viability
- 2) Applicability to Service Territory
- 3) Best Available Technology
- 4) Quality Data
- 5) Acceptability of Measure by Customer
- 6) Duplication

| Technology Area | Number of Measures | | |
|-----------------------------|--------------------|---------------|------------|
| | Universal List | Passed Screen | % of Total |
| Energy Efficiency (EE) | 94 | 51 | 54% |
| Demand Response (DR) | 44 | 14 | 32% |
| Distributed Generation (DG) | 31 | 11 | 35% |
| Energy Storage (ES) | 18 | 5 | 28% |
| Total | 187 | 81 | 43% |

Potential by segment and technology

| 17 Market Segments | |
|-----------------------|--|
| Residential | Single Family |
| | Small Multi-Family (2-4 units) |
| | Large Multi-Family (> 5 units) |
| Commercial/Industrial | Office-Large (> 50,000 sqft) |
| | Office-Small (< 50,000 sqft) |
| | Restaurant |
| | Retail |
| | Grocery |
| | Warehouse |
| | Education |
| | Hospital |
| | Nursing Home |
| | Lodging |
| | Entertainment |
| | Miscellaneous |
| | Multi-Family Residential (common areas only) |
| | Industrial |



| 15 End Use Load Shapes |
|------------------------------|
| Total Facility (Electric) |
| Total Lighting (Electric) |
| Lighting Interior (Electric) |
| Lighting Exterior (Electric) |
| Plug Loads (Electric) |
| Cooling (Electric) |
| Heating (Electric) |
| Fans/Ventilation (Electric) |
| Total HVAC (Electric) |
| Refrigeration (Electric) |
| Hot Water (Electric) |
| Total Facility (Gas) |
| Heating (Gas) |
| Hot Water (Gas) |
| Interior Equipment (Gas) |

IDS Model can evaluate DSM cost effectiveness from all perspectives



Societal
Cost Test
(SCT)



Total
Resource
Cost Test
(TRC)



Utility Cost
Test (UCT:
GT&D or
T&D)



Participant
Cost Test
(PCT)



Rate
Impact
Measure
(RIM)



Sample IDSM Analysis

Analytica Model Inputs Interface

Data Import and Refresh

| Model Run Inputs | |
|--------------------------|----------------------------|
| Active Network Selection | Edit Table |
| Model Start Year | 2014 |
| Model End Year | 2018 |

| Network Inputs | |
|--------------------------------------|----------------------------|
| NYISO Load Zones | Zone I Upper Bron... |
| Municipality | City of New York |
| Transmission Region | Brooklyn |
| CECONY Service for Alternative Fuel? | Edit Table |

| Portfolio Inputs | |
|---|----------------------------|
| Procurement Target | Load Reduction |
| Peak Load Reduction Target | Annual |
| Annual Peak Load Reduction Target (MW) | Edit Table |
| Total Peak Load Reduction Target (MW) | 41 |
| Incremental Peak Load Reduction Threshold | 100% |
| Cost Test Weights | Edit Table |
| Network PCAF Hours Method | Standard Deviation |
| Network PCAF Hours (Hours) | 100 |
| PCAF Weighting | Weighted |
| Budget Target | Annual |
| Annual Budget (\$) | Edit Table |
| Annual Admin Budget (\$) | Edit Table |
| Total Budget (\$) | \$136.1M |
| Total Admin Budget (\$) | \$13.61M |
| Budget Threshold | 100% |

| Avoided Cost Inputs | |
|---------------------------------------|----------------------------|
| GTD or TD perspective for cost tests? | TD |
| System Energy Loss Factor | Edit Table |
| System Capacity Loss Factor (% of kW) | Edit Table |
| System PCAF Hours Method | Standard Deviation |
| System PCAF Hours (Hours) | 100 |
| T&D Avoided Cost Component Selection | Edit Table |

| Financial Inputs | |
|------------------------|----------------------------|
| Societal Discount Rate | 2% |
| Utility WACC | 7% |
| Customer Discount Rate | Edit Table |
| Dollar Years for Model | 2014 |

| Customer Inputs | |
|--------------------------------------|----------------------------|
| Customer Type Mapped to Tariff | Edit Table |
| Dollar Year for Tariff Prices (Year) | 2013 |
| Tariff Escalation Rate | 2% |
| Customer Type Service Voltage | Edit Table |

| DR Program Definition | |
|-----------------------|----------------------------|
| Program Properties | Edit Table |

| T&D Investment Plan Inputs | |
|----------------------------------|----------------------------|
| T&D Investment Plan | Edit Table |
| Capital Recovery Factor (%) | 10% |
| TD investment Inflation Rate (%) | 2% |

| Adoption Curves | |
|----------------------------------|-----|
| Use payback and S-curve for CSG | No |
| Use payback and S-curves for EE | Yes |
| Use payback and S-curves for STR | No |
| Use payback and S-curves for DR | No |

| Measure Incentive levels and Utility Costs | |
|--|----------------------------|
| Max Portfolio Composition (%) | Edit Table |
| All Measure B/C Threshold (B/C Ratio) | 1 |
| Technology B/C Threshold | Edit Table |

| Portfolio Adjustment Inputs | |
|---|----------------------------|
| EE Peak Reduction Multiplier | 1 |
| DR Peak Reduction Multiplier | 1 |
| STR Peak Reduction Multiplier | 25 |
| CSG Peak Reduction Multiplier | 1 |
| EE Forced Measure Selection (Measures) | Edit Table |
| DR Forced Measure Selection (Measures) | Edit Table |
| CSG Forced Measure Selection (Measures) | Edit Table |
| STR Forced Measure Selection (Measures) | Edit Table |
| EE Measure Inclusion | Edit Table |
| DR Measure Inclusion | Edit Table |
| CSG Measure Inclusion | Edit Table |
| STR Measure Inclusion | Edit Table |

Analytica Model Outputs Interface

Portfolio Selection Results

| | | |
|-------------------------|-------------------------------------|-----|
| Annual EE Measures | <input type="button" value="Calc"/> | mid |
| Cumulative EE Measures | <input type="button" value="Calc"/> | mid |
| Annual DR Measures | <input type="button" value="Calc"/> | mid |
| Cumulative DR Measures | <input type="button" value="Calc"/> | mid |
| Annual CSG Measures | <input type="button" value="Calc"/> | mid |
| Cumulative CSG Measures | <input type="button" value="Calc"/> | mid |
| Annual STR Measures | <input type="button" value="Calc"/> | mid |
| Cumulative STR Measure | <input type="button" value="Calc"/> | mid |

Measure Cost Effectiveness Results

| | | | |
|--------------------------------------|-------------|-------------------------------------|-----|
| EE Benefit/Cost Ratios | (B/C Ratio) | <input type="button" value="Calc"/> | mid |
| DR Benefit/Cost Ratios | (B/C Ratio) | <input type="button" value="Calc"/> | mid |
| CSG Benefit/Cost Ratios | (B/C Ratio) | <input type="button" value="Calc"/> | mid |
| STR Benefit/Cost Ratios | (B/C Ratio) | <input type="button" value="Calc"/> | mid |
| EE NPV Lifecycle Costs and Benefits | (NPV\$) | <input type="button" value="Calc"/> | mid |
| DR NPV Lifecycle Costs and Benefits | (NPV\$) | <input type="button" value="Calc"/> | mid |
| CSG NPV Lifecycle Costs and Benefits | (NPV\$) | <input type="button" value="Calc"/> | mid |
| STR NPV Lifecycle Costs and Benefits | (NPV\$) | <input type="button" value="Calc"/> | mid |

Calculate Portfolio

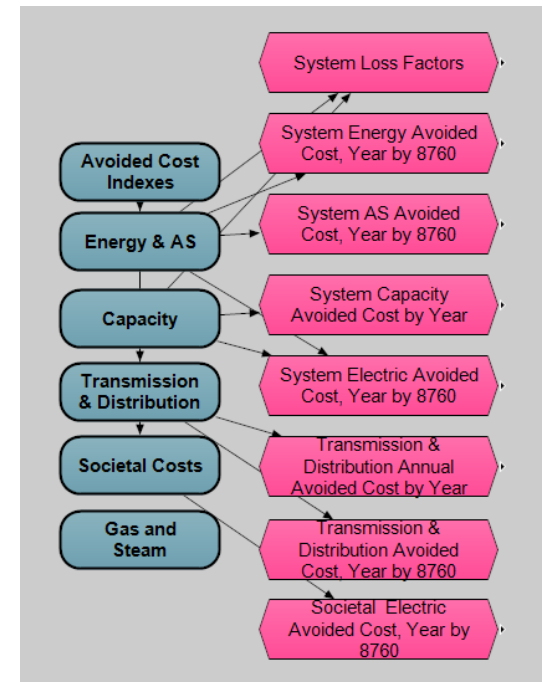
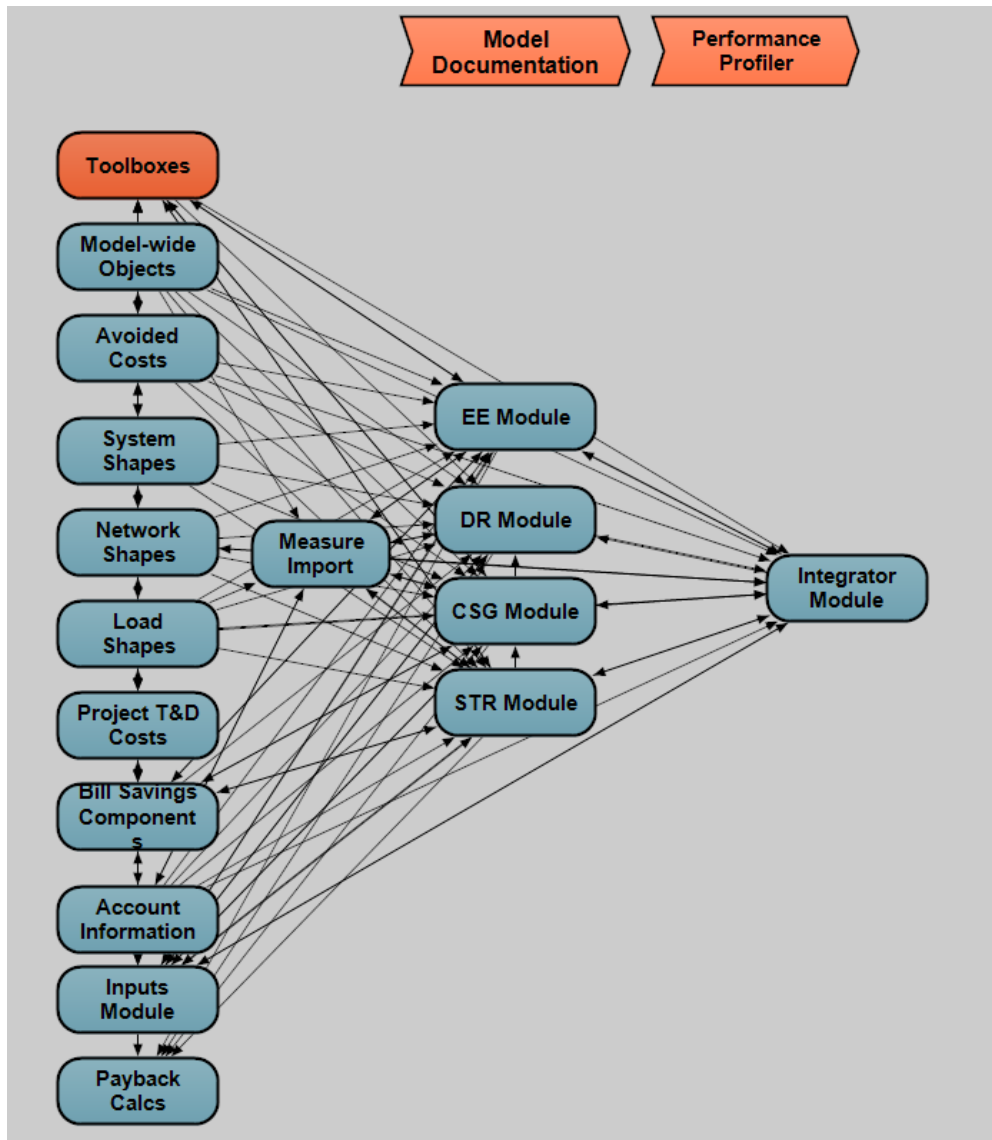
Portfolio Results

| | | | |
|---|---------|-------------------------------------|-----|
| Technology Portfolio Cost-Effectiveness | (NPV\$) | <input type="button" value="Calc"/> | mid |
| Total Portfolio Cost Effectiveness | (NPV\$) | <input type="button" value="Calc"/> | mid |
| Technology Portfolio Benefit/Cost | (NPV\$) | <input type="button" value="Calc"/> | mid |
| Total Portfolio Benefit/Cost | (NPV\$) | <input type="button" value="Calc"/> | mid |
| Total Portfolio Net Benefit | (NPV\$) | <input type="button" value="Calc"/> | mid |

Other Results

| | | | |
|--------------------------|---------|-------------------------------------|-----|
| Network loads | (MW) | <input type="button" value="Calc"/> | mid |
| Peak Day Network Loads | (MW) | <input type="button" value="Calc"/> | mid |
| Total Network PCAF Hours | (Hours) | <input type="button" value="Calc"/> | mid |
| Total System PCAF Hours | (Hours) | <input type="button" value="Calc"/> | mid |

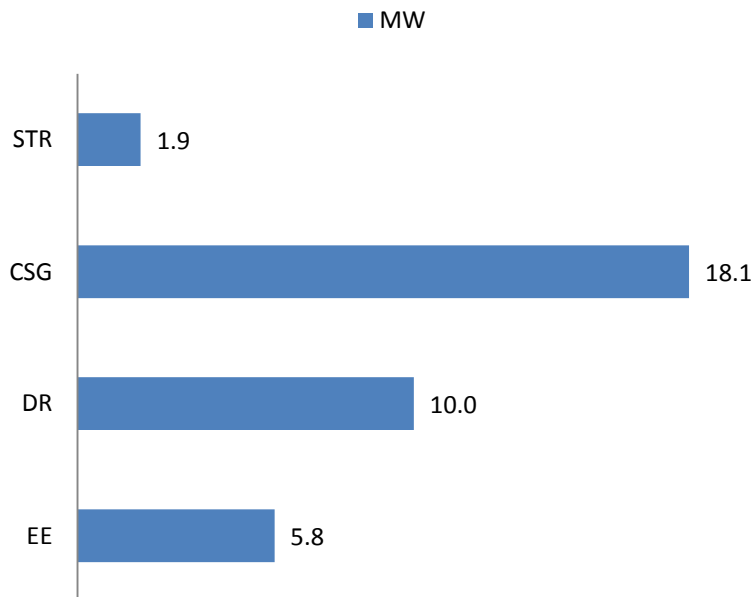
Analytica Model Examples Modules



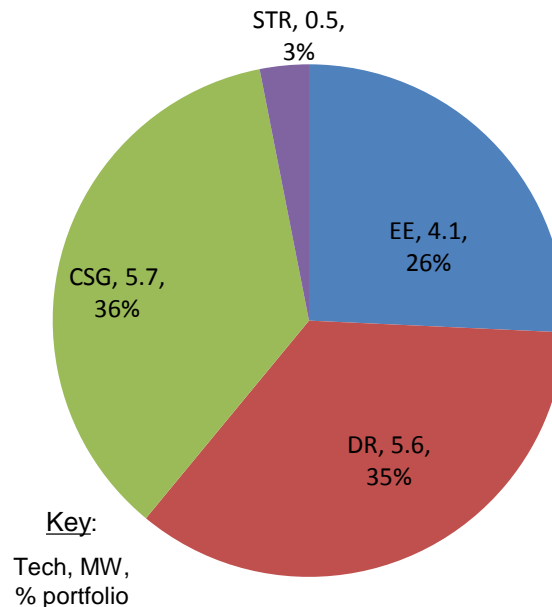
IDSMSample Analysis

- Model assumptions: portfolio analysis for DSM need of 16 MW (~10% of network peak demand) over the next 4 years (2015-2018); customer incentives based on 3 year customer payback

Individual Technical Potentials with non-economic CSG forced



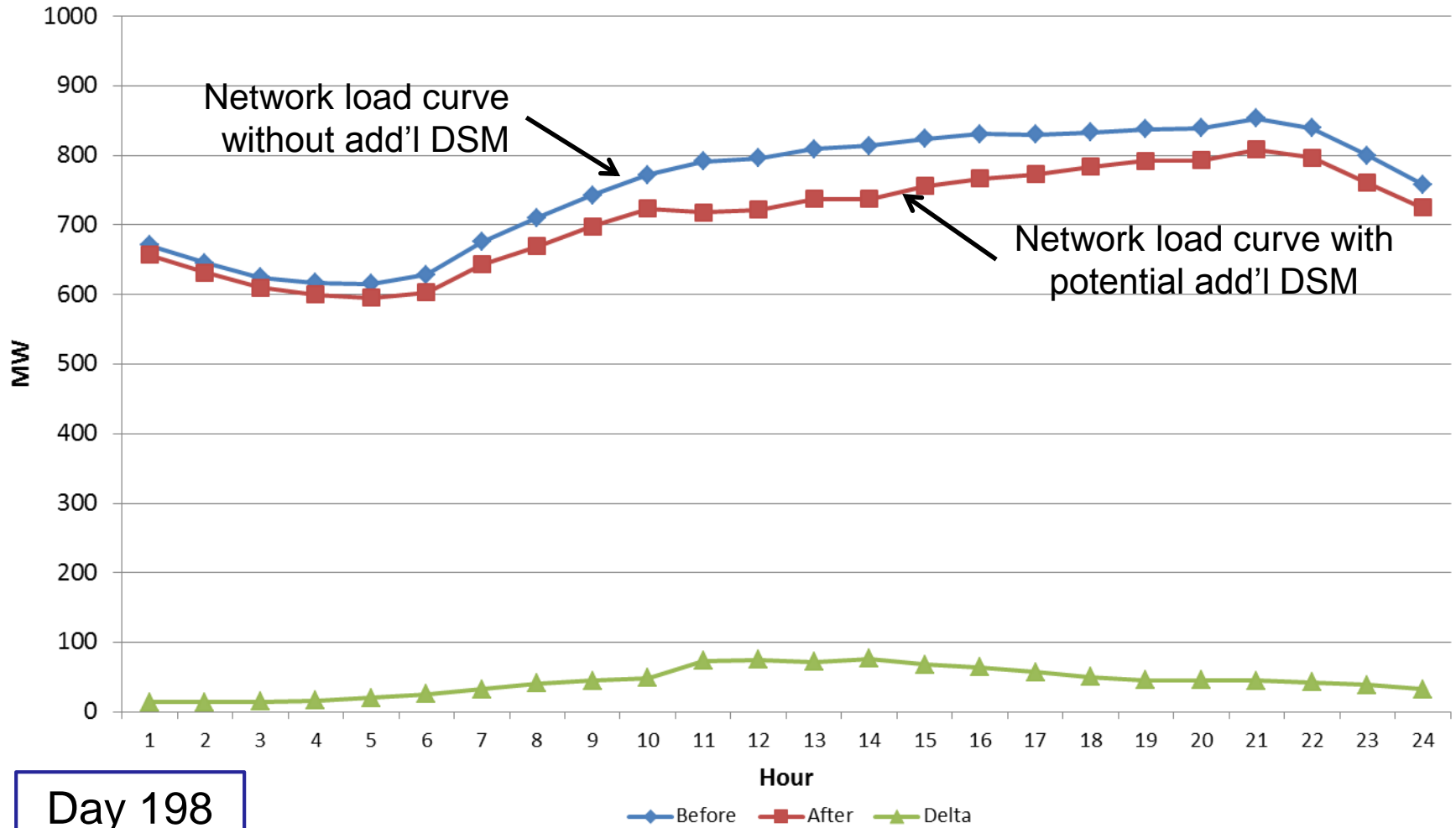
Economic Potential for a Balance Portfolio



Takeaways:

- Not all potential is economic
- Economic Potential exists to meet load relief need
- Deeper dive to assess achievable potential

IDSM output compares network peak demand with and without DSM potential



Day 198

IDS_M Model Next Steps

- Update benefit cost test(s) for REV
- Update and expand measures list and costs
- Build day and hour targeting inputs
- Enhance customer segmentation and load curves
- Expand to more granular system view (below network)
- Expand capabilities for strategic planning forecasts

Other Con Edison ACEEE Presentations

- Today: Session 2B – 3:30pm to 5:30pm
 - Energy Efficiency as a Targeted Transmission and Distribution Resource
 - Presenter: **Josh Bode**, Nexant