DPS Technology Panel
May 26, 2016
## Optimizing the Delivery System

### Generation
- Move Load Following to Base Generation
- Ramp rate support
- Minimize Spinning Reserve
- Wind Integration
- Solar Integration
- Frequency Control
- Black Start support

### Transmission
- Reduce Congestion
- Reduce Line Loss by shifting more load to off peak hours
- Reduce Substation Loading
- Power Quality

### Distribution
- Reduce Distribution Substation Stress
- Reduce Line Loss
- Voltage Support
- Support distributed generation
- Power Factor Support

### EDGE of the Grid
- Leverage TOU pricing
- Demand Charge Reduction
- Demand Response
- Firm Distributed Solar
- Critical Backup power
- Aggregation for Virtual Dist. Utility model

## Known benefits to storage integration

- **Increasing Locational Value**
New York Load- Generator Optimization

Load vs. LBMP | Flow | Real-Time Fuel Mix

2/22/2016 – Zonal Load
Click and drag in the plot area to zoom in

4 Hr. Peak

Load Following Generation

Convert Load Following to Base

Base Load Generation

<table>
<thead>
<tr>
<th>Heat Rate (Btu/kWh)</th>
<th>GHG (lbs CO₂/kWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10,000</td>
<td>1.171</td>
</tr>
<tr>
<td>8,000</td>
<td>0.936</td>
</tr>
<tr>
<td>6,000</td>
<td>0.702</td>
</tr>
</tbody>
</table>

Source: EIA
Wind Production in BPA Area

Wind Production

BPA Load

Non-correlation of load and wind production

Correlated load and supply

Based on 5-min readings from the BPA SCADA system for points 45583, 79687, 79682, and 79685
Balancing Authority Load in Red, Wind Gen. in Blue, Hydro Gen. in Green, and Thermal Gen. in Brown
Installed Wind Capacity=2836 MW
BPA Technical Operations (TOT-OpInfo@bpa.gov)
Value of Line Loss Reduction

Line Loss is often Averaged

- Energy Generated-Energy Delivered
  Energy Generated
  Measured over a set time period (24 Hrs)

- Line Loss is not Linear to Load
  Peak Load  11441 MW  =  1.46
  Trough Load  7827 MW

  Peak Loss  670 MW  =  2.15
  310 MW
Solar Peaker Plant

✅ Solar Production - Time shifted to period of highest benefit
✅ All intermittent performance removed
✅ Allows the resource to be scheduled and dispatched

Solar Power

Firm Afternoon Solar Production with Stored Energy 400 kW/2400 kWh
# Rate Evolution

## Monthly

<table>
<thead>
<tr>
<th>Rate</th>
<th>Total Delivery Charges</th>
<th>Daily</th>
<th>Hourly</th>
</tr>
</thead>
<tbody>
<tr>
<td>$13,457.90</td>
<td>$12,345.67</td>
<td>$1,110.30</td>
<td>$1,110.30</td>
</tr>
</tbody>
</table>

## Daily

### As Used Daily Demand

<table>
<thead>
<tr>
<th>Date</th>
<th>Projected Daily Demand</th>
<th>Hourly Demand</th>
</tr>
</thead>
<tbody>
<tr>
<td>May 15, 2022</td>
<td>2,500 kWh</td>
<td>2,500 kW</td>
</tr>
</tbody>
</table>

## Hourly

### Day Ahead Market Zonal LMP

<table>
<thead>
<tr>
<th>Zone</th>
<th>Price ($/MWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Texas</td>
<td>50.25</td>
</tr>
<tr>
<td>Midwest</td>
<td>48.75</td>
</tr>
</tbody>
</table>

### Energy-Demand Relationship

<table>
<thead>
<tr>
<th>Hourly Demand</th>
<th>Daily Demand</th>
</tr>
</thead>
<tbody>
<tr>
<td>2,500 kW</td>
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Focus On Value

- Storage is here and can respond as Load or Generation
- Allow Storage to earn FLEC Credits Based on Value Delivered
- Storage can respond remotely - does not require colocation
- Value focused on GHG Reductions from Current Generation Fleet
- Optimize Wind Generation and move Off-Peak Power to edge of the Grid
- Replace inefficient Gas Peaker fleet with Solar+Storage
- Time based rate structures that represent true marginal cost

Let’s Move Forward