Enhancing customer value through system planning: the increasing role of storage and renewables

Presented to NASUCA Mid-Year Meeting
June 21, 2019
APS Example: Natural gas additions were virtually unchanged across all IRP scenarios

Future NGCC Capacity

- Flexible Resource (selected)
- Carbon Reduction
- Energy Storage
- Expanded Renewables
- Expanded DSM
- Nuclear SMR
- Resource Mandates
Recent Wind and Solar Project Prices

- Arizona
  - $0.025 /kWh
  - AZ Solar 1 (CAP)

- Nevada
  - $0.027 /kWh
  - Battle Mountain (NVE)

- Utah
  - $0.028 /kWh
  - Average Bid Price (PacifiCorp)
Recent Wind and Solar Project Prices

- **Montana**
  - $0.022 /kWh
  - South Peak (NorthWestern)

- **Colorado**
  - $0.019 /kWh
  - Xcel Energy (2017 Median Bid)

- **New Mexico**
  - $0.019 /kWh
  - Sagamore (SPS)
Colorado Resource Comparison

Levelized Cost of Energy (Simple Comparison)

LCOE ($/MWh)

- Rawhide
- Pawnee
- Comanche 3
- Martin Drake 7
- Nixon
- Martin Drake 6
- Hayden 1
- Craig 2
- Hayden 2
- Craig 3

- Solar PV (CO)
- Xcel Coal Units (Fuel, O&M & Incr. CapEx)
- Wind (CO)
- Non-Xcel Coal Units (Fuel, O&M, & Incr. CapEx)
Reliability & Flexibility from Inverter-based Resources

Regulation Up Accuracy

Blue bars taken from the ISO’s informational submittal to FERC on the performance of resources providing regulation services between January 1, 2015 and March 31, 2016.
Entergy New Orleans – Peaker Plant Proposal

Figure 2. Illustrative net cost comparison of a 128 MW natural gas peaker (left) and 128 MW, 4-hour, battery energy storage (right). Peaker capital and fuel costs based on the ENO Alternative Peaker (Wartsila) and Battery capital costs (low case) shown in Table 1. Energy revenue and charging costs based on 2017-18 MISO Louisiana Hub price data. Assumes Ancillary Services revenue for battery from regulation at $5/MWh and for peaker from spinning reserves at $2/MWh.
Hybrid Resource Cost Comparison vs. Standalone Storage

Unsubsidized Levelized Cost of Storage Comparison—$/kW-year

$35/kW-yr = estimated cost for hybrid resource (storage retrofit)

Sources: Gridwell Consulting, Hybrid Storage Technology, July 2018; https://docs.wiki.static.com/ugdf468bf_ff74e8c24c6d4907b8bea661be9f99df.pdf
# Energy Storage as a Capacity Resource in New York ISO

<table>
<thead>
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<th>Durations (hours)</th>
<th>Incremental Penetration of resources with duration limitations</th>
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<tr>
<td></td>
<td>Less than 1000 MW</td>
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<tr>
<td>2</td>
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Key Takeaways

▪ There is the potential for substantial cost savings versus traditional new and even some traditional existing resources.

▪ This does not mean savings will necessarily be realized
  ▪ Planning assumptions matter
  ▪ Implementation details matter
Questions to ask in the planning process:

- Are there meaningful differences between the “preferred option” and the alternatives?
- Is the planning process linked to a fair & competitive process to solicit the most cost-effective resources?
- Does the planning process allow for economic retirements or only additions?
- What is the true need for a proposed resource? Which specific reliability constraints are driving this & are all solutions being considered and are the assumptions up to date?
- In restructured markets, are non-traditional resources being appropriately valued by the RTO/ISO?
Thank You!

Edward Burgess

eburgess@Strategen.com

941-266-0017
Arizona Resource Comparison

Equivalent Resource Cost Comparison

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<tr>
<th>Total Annualized Costs Millions</th>
<th>Existing Coal</th>
<th>New Gas (CCGT)</th>
<th>New Gas Peakers + Market Purchases</th>
<th>DR &amp; Solar+Storage (w/mkt. purchase)</th>
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