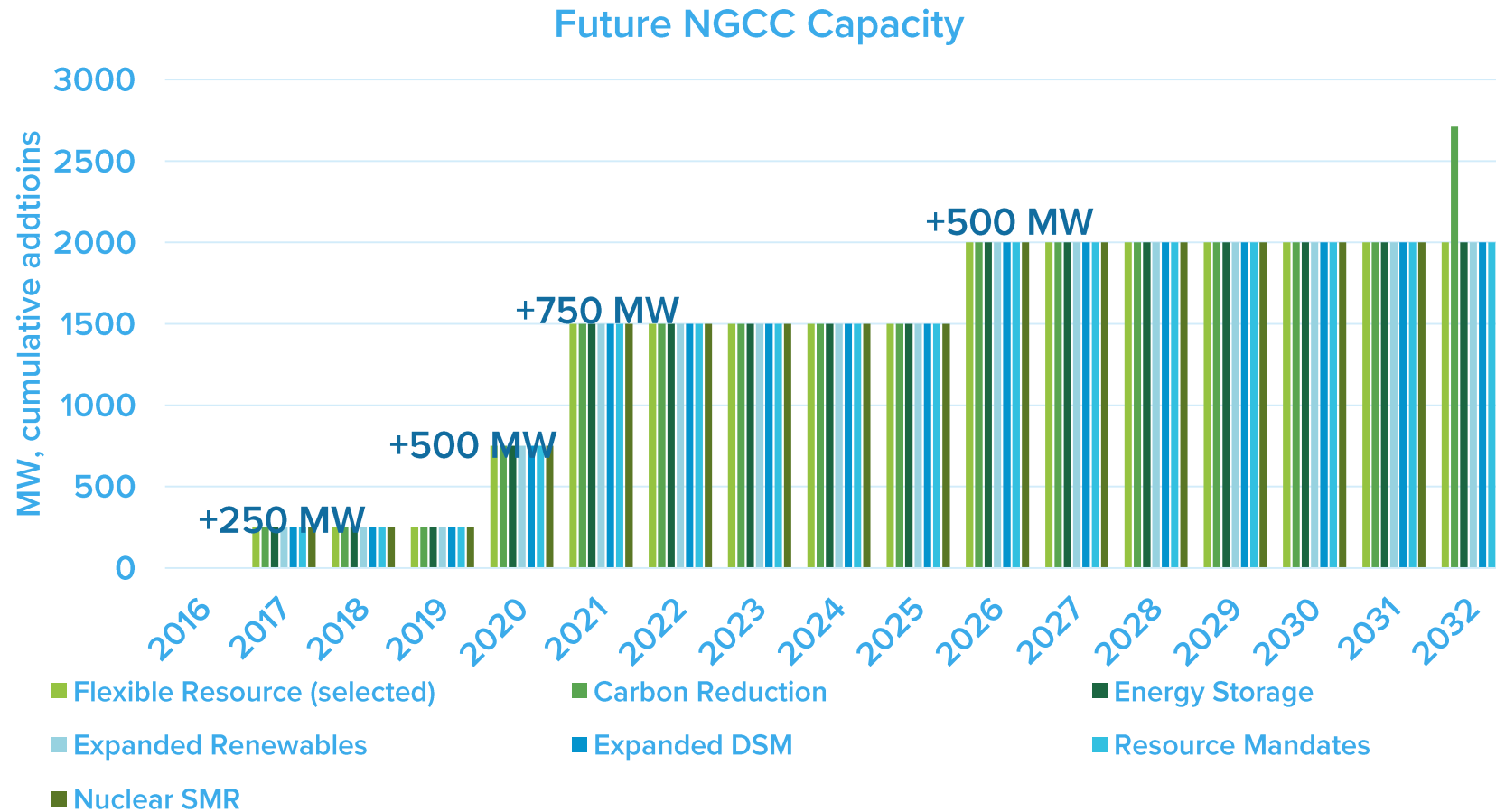










Enhancing customer value through system planning: the increasing role of storage and renewables

Presented to NASUCA Mid-Year Meeting
June 21, 2019

APS Example: Natural gas additions were virtually unchanged across all IRP scenarios



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

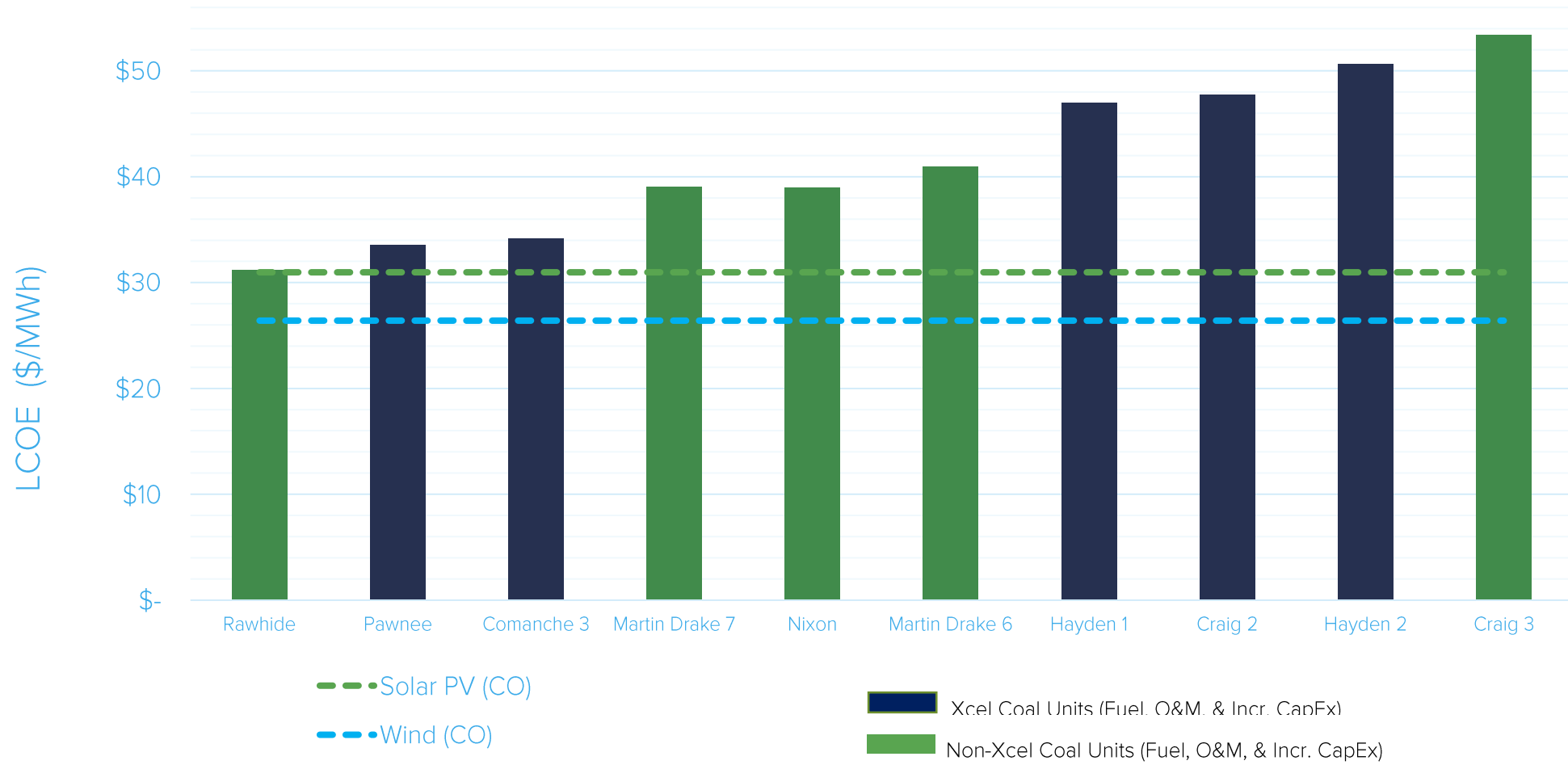


\$0.019 /kWh

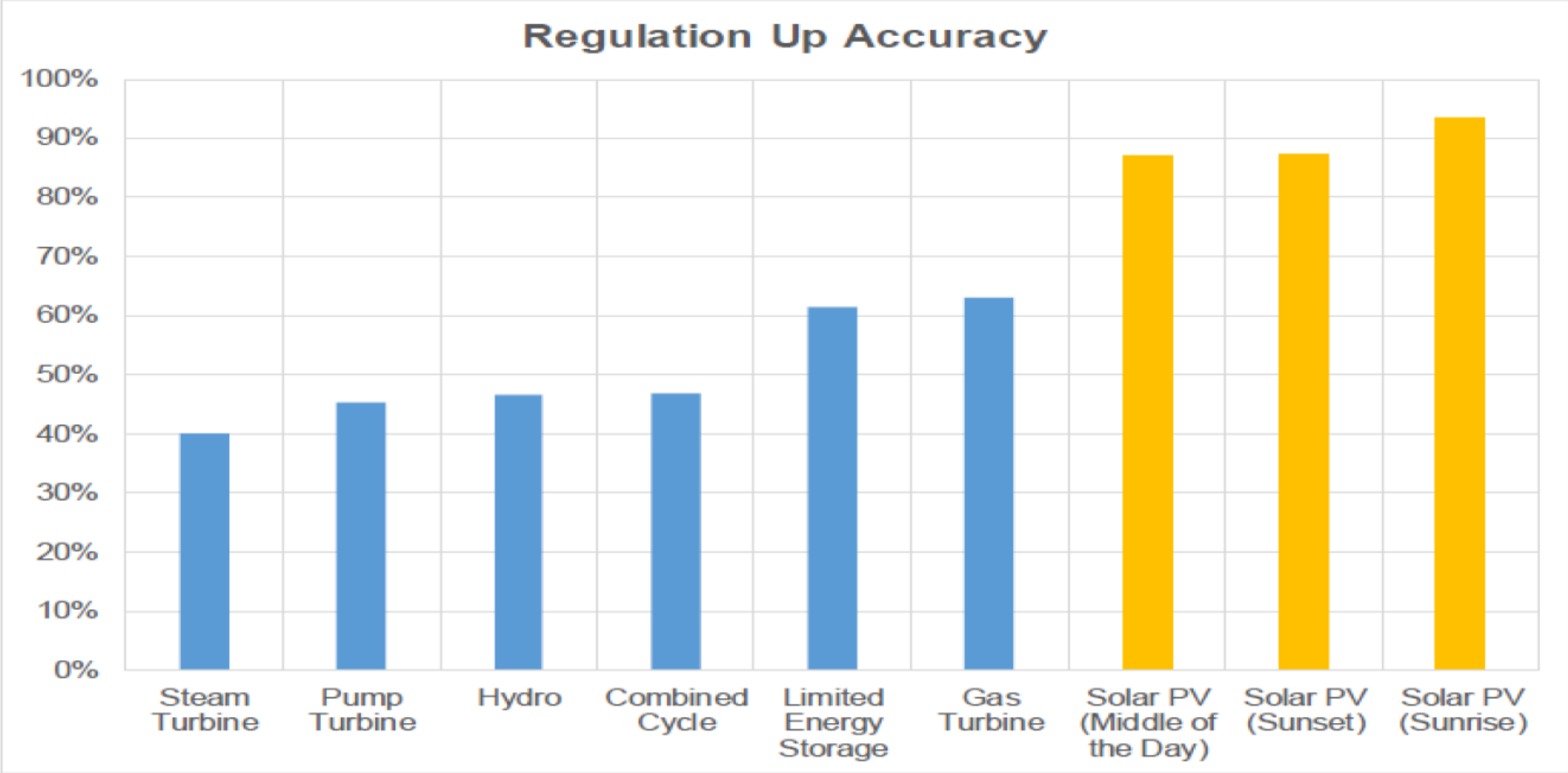
Sagamore (SPS)

Colorado Resource Comparison

Levelized Cost of Energy (Simple Comparison)



Reliability & Flexibility from Inverter-based Resources



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

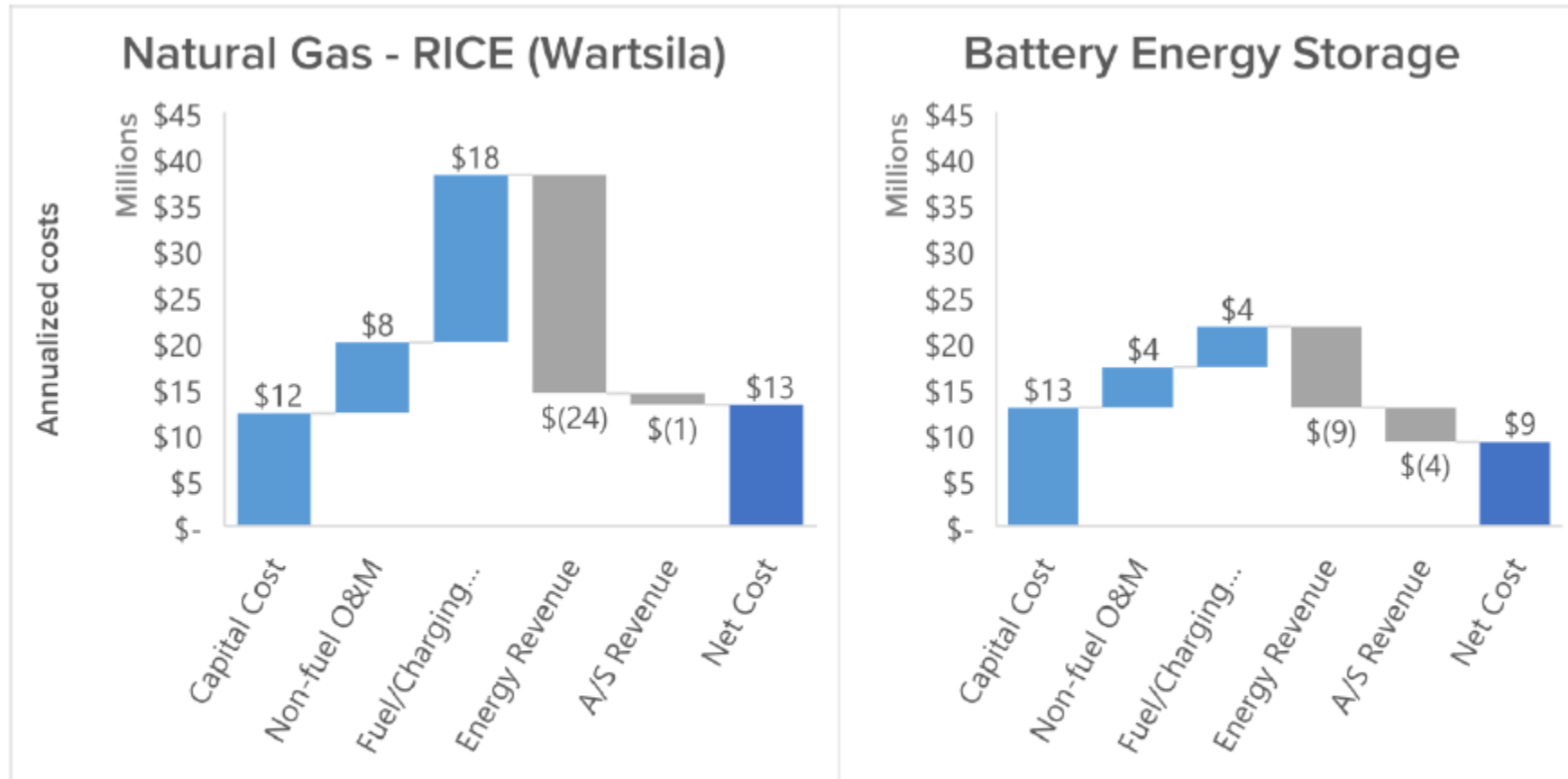


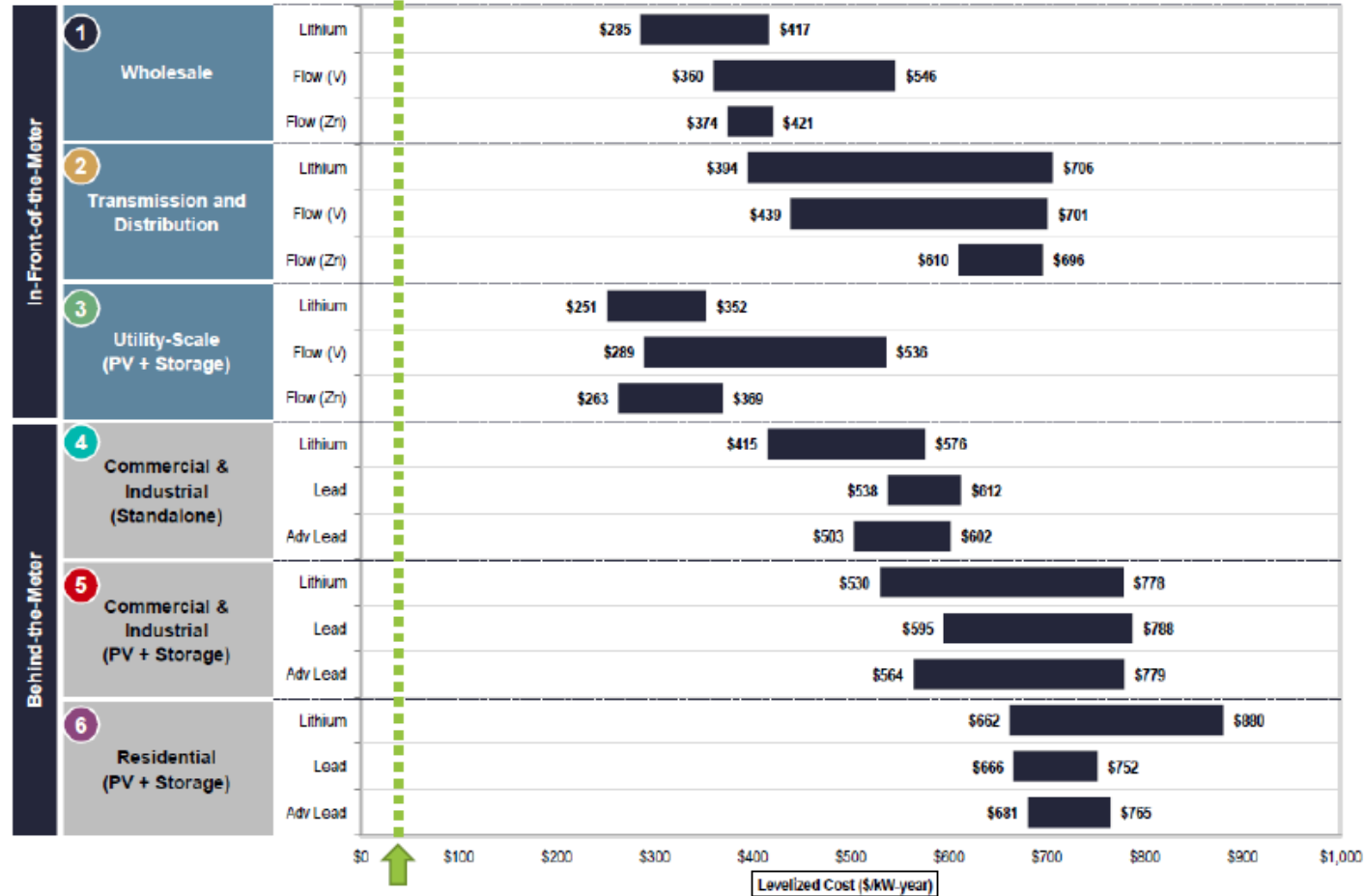
Figure 2. Illustrative net cost comparison of a 128 MW natural gas peaker (left) and 128 MW, 4-hour, battery energy storage (right). Peaker capital and fuel costs based on the ENO Alternative Peaker (Wartsila) and Battery capital costs (low case) shown in Table 1. Energy revenue and charging costs based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

Hybrid Resource Cost Comparison vs. Standalone Storage

LAZARD

B LAZARD'S LEVELIZED COST OF STORAGE ANALYSIS V4.0

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.wixstatic.com/ugd/fe68bf_ff74a8c24c6d4907b8bea661be9f99df.pdf

Lazard, *Levelized Cost of Energy Storage*, November 2018, <https://www.lazard.com/perspective/levelized-cost-of-energy-and-levelized-cost-of-storage-2018/>

Energy Storage as a Capacity Resource in New York ISO

	Incremental Penetration of resources with duration limitations	
Durations (hours)	Less than 1000 MW	At and Above 1000 MW
2	45%	37.5%
4	90%	75%
6	100%	90%
8	100%	100%



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!

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Arizona Resource Comparison

