

COLORADO RURAL ELECTRIC ASSOCIATION ENERGY INNOVATIONS SUMMIT

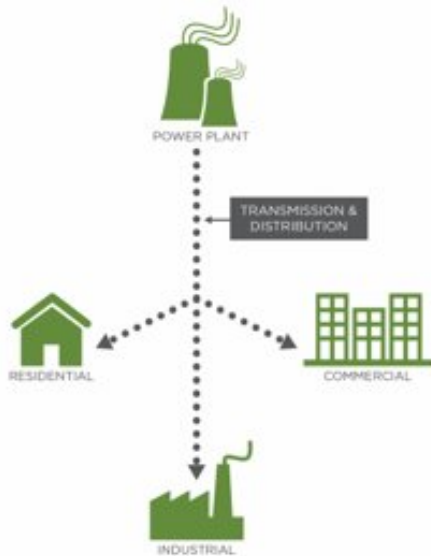
ALEX ELLER
SENIOR RESEARCH ANALYST
ALEX.ELLER@NAVIGANT.COM

OCTOBER 28, 2019

THE ENERGY CLOUD TRANSFORMATION

Past

Traditional Power Grid



Central, One-Way Power System, focused on Safe, Reliable and Affordable power

©2019 Navigant Consulting, Inc. All rights reserved.

Emerging

The Energy Cloud



Distributed, Cleaner, Two-Way Power Flows, Mobile energy resources, new digital Energy Cloud platforms

©2019 Navigant Consulting, Inc. All rights reserved.

ENERGY STORAGE MARKET SEGMENTS

Utility-Scale



- Larger-scale energy storage located on the utility side of the meter
- Key applications include:
 - peak pricing arbitrage
 - generation capacity
 - transmission and distribution (T&D) asset capacity
 - frequency regulation
 - volt/volt-ampere reactive (Volt/VAR) support
 - renewables integration

Behind-the-Meter



- Customer side of the meter, including commercial / industrial (C&I) and residential systems
- Drivers for behind-the-meter energy storage include:
 - Energy cost management
 - On-site generation self-consumption
 - Backup power/improved power quality

Remote Power Systems

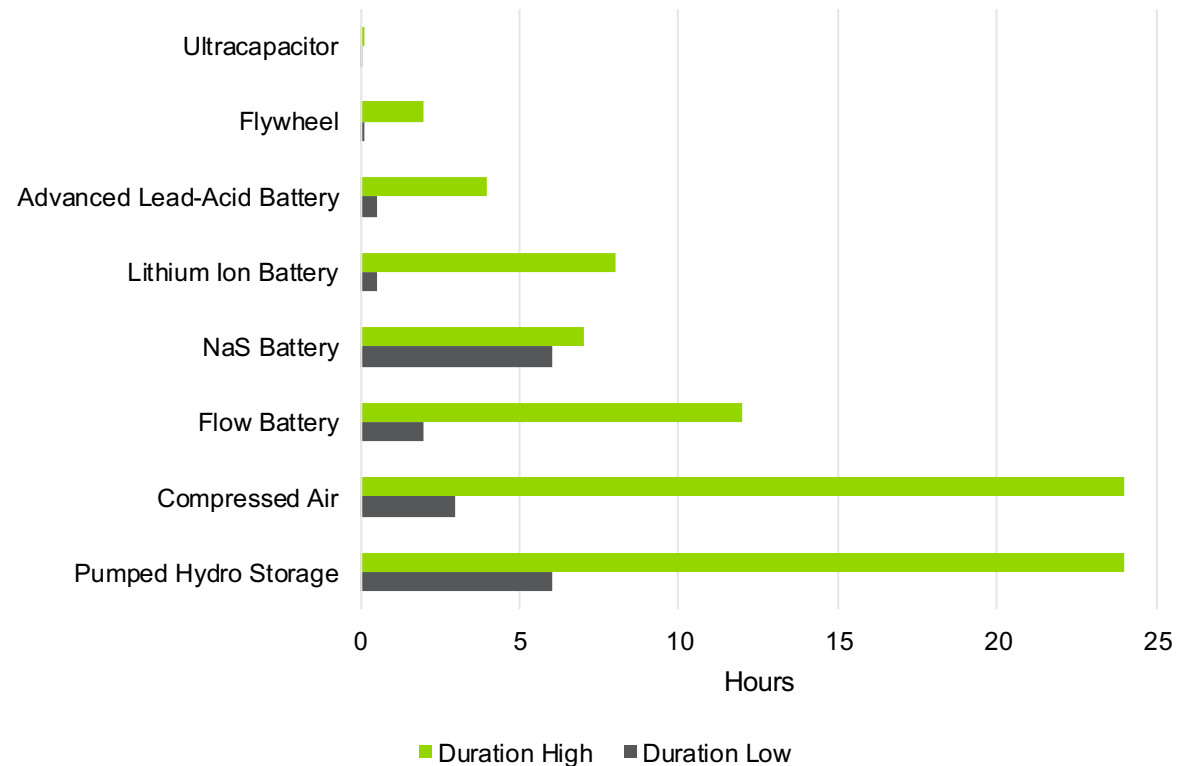


- Not typically interconnected with a utility grid, or may interconnect with a highly unreliable grid.
- Often addressing frequency and voltage challenges within a tightly confined network.
- Reduced diesel fuel consumption and integration of renewable energy are key drivers for energy storage in this market

LONG VS. SHORT DURATION ENERGY STORAGE

- Eight primary energy storage technologies providing services on the power grid
- Technologies are varied in:
 - Average scale per project (kW to GW)
 - Average discharge duration
- Large-scale long duration energy storage provides greater flexibility to serve multiple applications from a single project
- Pumped hydro storage accounts for approximately 93% of operational energy storage capacity worldwide

Energy Storage Technologies: Discharge Duration Range



Source: Navigant Research