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Energy Storage in the Mountain State

Opportunities for Growth

Agenda

Q&A at the end

- 1. Fluence Introduction
- 2. Energy Storage Applications and Use Cases
- 3. Energy Storage Technology and Products
- 4. Opportunities for Storage in West Virginia



Fig. 3 — Load Diagram of 53d St. Station, Edison IIluminating Co., of New York City, Sept. 30. 1893.

Source: Engineering News, Vol. 30, p 358, Nov. 2, 1893.

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"After a 100-year Hiatus, Batteries are Helping Again"

More than 120 years ago, batteries were commonplace on the power grid. Thanks to Thomas Edison's vision, many central station power plants and distribution networks utilized battery systems in the 1890s. This chart shows a 19th century "duck curve" for New York City, and demonstrates the key role that batteries played in smoothing the peaks and valleys of electricity demand throughout the day and night in Edison's time.

Energy Storage Market Poised for rapid growth throughout the 2020s as new markets, applications, and customers emerge

| 60,000 | | | | | | | | | | | \$33 Billion investment | in annual t into ESS | |
|--------------------|------|-----------------------------|------------------|------|------------|------|-------------|--------|------|------|----------------------------|-------------------------|------|
| 50,000 | | | | | | | | | | | | | |
| Deployed 40'000 | | | | | | | | | | | | | |
| 000'05 000'05 | | | | | | | _ | | | | | | |
| 20,000 Increm | | Market brea despite COVI | ks 10 GW D-19 | | | | | | | 2 | | | |
| 10,000 | | | | | B . | | | | | | | | |
| | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 |
| | | | | | | APAC | FMFA | Buffer | | | | | |



Fluence Introduction

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Where we started....

12 MW Los Andes Array Chile, Atacama Desert

OUR MISSION

Transform the way we power our world



Today we are creating an ecosystem with three business lines

Store of the state of the state



Fluence has grown the energy storage industry at home

PROJECT



HIGHLIGHTS

- Largest storage project (20 MW) in the Midcontinent ISO (at the time)
- Stabilizing the Midcontinent ISO grid
- Operational since 2017
- Co-located with existing natural gas combined cycle plant
- Innovative storage-as-transmission-asset deployment
- Alternative to traditional transmission upgrade at less than half the cost
- Operational since 2018
- Fluence's First Storage Peaker Using Gridstack
- Supply capacity peak power to the local grid
- Commissioned in 2021

Including West Virginia!



- Largest lithium-ion project in the world at time of commissioning (32 MW, 2011)
- Co-located with wind farm; early test of using storage to optimize renewable revenues
- Providing grid balancing services to PJM region



Energy Storage Applications and Use Cases

Benefits of Storage and Value Stacking

- Bidirectional charge and discharge – allows it to perform more services
- Versatile services Both Real and Reactive power capabilities
- Delivers value for owners and operators alike



There are three categories of energy storage applications to address the full spectrum of customer use cases

| TRANSFORM YOUR NETWORK | TRANSFORM YOUR GENERATION | TRANSFORM YOUR ENERGY USE |
|------------------------------|---------------------------|---------------------------|
| Peak Load Relief | Frequency Regulation | Back-up Power |
| Congestion Management | Flexible Peaking Capacity | Energy Cost Control |
| Contingency Back-Up | Wholesale Energy Trading | Microgrids |
| Distribution Reliability | Renewables Co-located | |
| | | |

Steep battery price decline is unlocking a range of business cases

Growing number of applications for energy storage both in front and behind the meter





FLEXIBLE PEAKING POWER

AES Alamitos Long Beach, California, United States 100 MW / 400 MWh

SERVICES

- Capacity, local reliability
- Peak power/off peak mitigation
- Ancillary services

IMPACT

- Competitive bid vs thermal peaker, cost effective
- Replaces environmental retired units
- Meets flexibility (duck curve)

Energy Cost Control

Daily Net Load Profile with Energy Storage



Flatten a facility's energy load profile

BENEFITS

Mining Facility

CHILE

5 MW

- Reduce peak demand charges by up to 50%
- Prevent facility interruptions with critical power

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Energy Storage Technology and Products

What is battery-based energy storage?

Large-scale batteries for utility and industrial applications



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Battery-based Energy Storage technology is mature and field proven technology



2

3

Purpose-built energy storage products to meet the needs of specific customer segments

Technology Stack provides a solid foundation for repeatable yet configurable products that can be manufactured at scale

A proven track record in deploying energy storage in 30 markets worldwide

14 years of storage innovation



2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021

Energy Storage System hierarchy and terminology

CUBE

Single physical container



NODE

Cube or string of cubes connected to a DC bus



CORE

Collection of Nodes connected to a transformer



ARRAY

 Collection of Cores connected to an interconnection – also called a system





FLUENCE IQ



FLUENCE OS



FLUENCE CUBE

Fluence 6th generation technology stack

Fluence IQ

Digital applications improve system decision-making, asset performance, and revenue generation with Al-driven insights, price forecasting, and automated bidding.

Fluence OS

Fully integrated operations platform gives operators comprehensive control, optimal asset management, and system visibility across single sites or entire fleets.

Fluence Cube

Modular, factory-built, standardized form factor delivers safe, scalable, cost-effective systems configurable with the latest storage components.

Fluence Cube – Safety Features



- 1. Battery Management System (BMS)
- 2. Fast Stop (F-Stop)
- 3. Incipient Gas Detection: Carbon Monoxide
- 4. Fire Detection and Suppression System
- 5. Deflagration Panels
- 6. Lockable Disconnect Switch
- 7. Open Door Sensor
- 8. Gas Spring Damper
- 9. Sliding Door Lock



Opportunities for Storage in West Virginia

PJM – Energy Storage Early Mover

- Early Mover: Market driver in PJM has been the ancillary services market
- Shallow market, limited potential for energy storage volume
- Alternative revenue/value streams need to be unlocked in the market



Commissioned energy storage projects located in U.S. ISO/RTO regions



Source: BloombergNEF, <u>Energy Storage Project Database</u>, EIA 861m Note: while projects are located in the region, projects are not necessarily be actively participating in the wholesale market. Excludes pumped hydro capacity.

Early Signs of a Rapidly Changing Generation Mix



Promising Signs for Energy Storage Growth in West Virginia

Standalone storage emerged with strength in 2021



Policy and Regulatory changes at PJM impacting energy storage in West Virginia

Even as Order 841 Models are approved, ongoing initiatives at PJM and efforts in WV can impact energy storage valuation and economic opportunity

Capacity Market Value

- Current market: "10-hour rule" no longer exists and shorter duration storage is more highly valued than before (no artificial constraints to storage)
- Filing with FERC currently to move to Effective Load Carrying Capacity (ELCC) structure

Storage-as-Transmission

- Current initiative to develop rules for integrating SAT in PJM planning
- Proper valuation of storage as a transmission/reliability asset
- Effort ongoing to consider planning and operational impacts

Order 2222 – Distributed Energy Resources

- Estimated to be approximately 16 MW of behind-the-meter resources
- Expand ability of DERs (including storage) to participate in PJM markets
- Compliance filing date: February 1, 2022

Setting an Energy Storage Deployment Goal – an immediate Opportunity to Promote Energy Storage Growth

What?

- Establish deployment targets/goals in the state for energy storage
- Set clear indication of the recognized value of energy storage for West Virginians

Why?

- Drive learning-by-doing among utilities, regulators, and agencies
- Send demand signals to developers and investors that West Virginia is open for business

Michigan ready to become 10th US state with an energy storage target

By Andy Colthorpe

April 25, 2022

N.J. sets 'aggressive' 2 GW storage target by 2030

The latest energy storage goal could inspire more states to follow.

Published May 29, 2018

Virginia regulators outline Dominion path toward 2.7 GW storage by 2035

Published Sept. 15, 2020 • Updated Dec. 23, 2020



Thank You

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