# Energy Storage
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# An ERCOT Perspective

ETWG – Storage Workshop

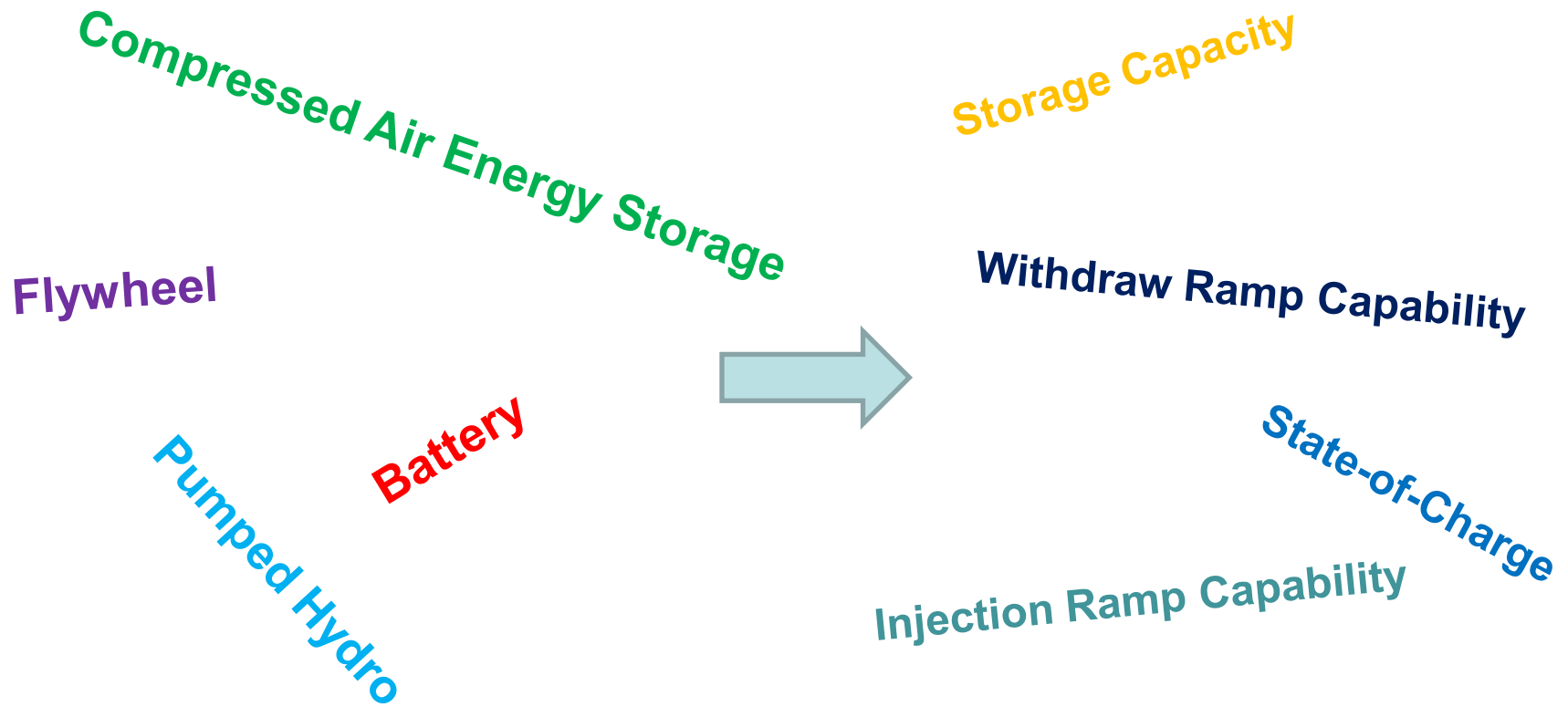Mark Patterson, ERCOT Manager Demand Integration

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- **ERCOT Protocols and PUCT Substantive Rules Governing Electric define only two types of Resources**
  - Generation Resources
  - Load Resources

- **Energy Storage does not fit well within either (or both) of these definitions**

# Challenges Integrating Energy Storage

- **There are a number of technologies that can be used to store energy**
- **Those various technologies have varying capabilities**

Compressed Air Energy Storage

Storage Capacity

Flywheel

Withdraw Ramp Capability

Battery

State-of-Charge

Pumped Hydro

Injection Ramp Capability

# Storage Projects in ERCOT

- **952 (876 CAES + 76 Battery ) MW under study or in development**
- **Project size is increasing**
- **Most MW are CAES**

# Challenges Integrating Energy Storage

- **What is Energy Storage (definition)?**

- **Registration & Modeling**

- **Capacity Testing**

- **Qualification to provide Ancillary Services**
  - Regulation Service (Up and Down)
  - Non-Spinning Reserve Service
  - Responsive Reserve Service

- **Providing Energy In ERCOT's Real-Time Energy Market**

- **Settlements when in Charging Mode**

**Energy Storage**

> A Resource with a capacity of one MW or greater which is capable of storing  energy and may qualify to supply Ancillary Services. The Energy Storage Resource at times can be charging (withdrawing) energy and at other times be discharging (injecting) energy.

# Registration & Modeling

**Issue #1:** No Energy Storage Class in the Common Information Model (CIM) or Registration Form currently exist

- CIM class for Generation and Load Resources only.
- Generation Resource - Energy, Regulation Up Service & Non-Spinning Reserve Service.
- Controllable Load Resource – Regulation Down Service.
- ERCOT's existing Energy Management and market Systems do not recognize negative (-) limits.

**Issue #2:** No Energy Storage Registration form in RARF

**Status:**

- New Registration Form for Energy Storage Resources under development.
- CIM model changes expected once Energy Storage Resource defined in Protocols.

# Capacity Testing

**Issue: Unannounced Capacity Test**

- Protocols require Resources that count toward ERCOT Reserves subject to an unannounced capacity test each year (NP-8.1.1.2).

- Once Resource reaches its Maximum output level it must sustain that level for 30 minutes

- Results of test also establishes the cap for offers into the Day-Ahead Ancillary Services Market

- Test is problematic for Technologies that are Energy Limited

**Status:**

- NPRR340 proposed language to exempt energy limited resources from test.

- Capacity from these resources will not be counted toward reserves.

- NPRR340 pending at TAC.

# Qualification to provide Ancillary Services

**Issue: Ancillary Services Purchased in hourly increments**

- Energy Storage May Qualify to provide
  - Regulation Service (Up and Down)
  - Non-Spinning Reserve Service
  - Responsive Reserve Service
- Resource Expected to have stored energy to provide service for full hour
- ERCOT is concerned with Technologies that are energy limited providing Responsive Reserve Service

**Status:**

- Energy limited resources will need to offer to provide at reduced capacity

# Energy In ERCOT's Real-Time Energy Market

**Issue: Resources expected to operate on Base Points**

- State-of-Charge (SOC) not built into Security Constrained Economic Dispatch (SCED)

- SCED projects where each resource needs to be 5 minutes into the future and sends base points every 4 seconds to get to that point. Resources are expected to stay on their base point. If not, Regulation Service must be used to make up difference.

- May be problematic for Energy Limited Resources

**Status:**

- NPRR340 proposed special rules for energy limited resources to manage their State of Charge and change telemetered resource status when projected to be empty.

# Settlements when in Charging Mode

**Issue:** **Settlement of Energy when in Charging Mode**

- Potential for Arbitrage when providing Energy
- PUCT Electric Rules require Loads to be charged at the Load Zone LMP while Resources get paid at the Resource Node LMP
- Prices may be predictably different and introduce arbitrage opportunity
- Is charging a retail or wholesale transaction

**Status:**

- NPRR410 proposed creating single electrical bus load zone.
- NPRR410 pending at PRS.
- Retail/wholesale transaction issue pending PUCT direction.

**Other Issues:**

- Start-Up offer and minimum Energy Offer Generic Caps
- Energy Offer Curve Caps for make Whole Calculations
- Mitigated Offer Floor
- Verifiable Cost Calculation
- Mitigated Offer Cap for SCED Mitigation

**Status:** Currently under discussion at ETWG

# Other Questions

1. **At the PUCT Oct. 6 workshop, ERCOT touched on the concept of treating storage as "storage", i.e., separate from "load" and/or "generation". What are the possible challenges and/or opportunities associated with such a consideration?**

   - If defined as a new Resource type the stakeholders could focus on "Storage" requirements as opposed to "fitting" them into either Generation or Load Resource requirements.

2. **Does it make sense to think of "storage" as a distinct ancillary service to be procured by ERCOT?**

   - ERCOT needs more information, maybe not a "storage" service but rather an enhancement to the regulation service.

3. **Is ERCOT considering system changes to "see" a storage unit's "state of charge" day ahead? hour ahead? real-time?**

   - No changes are being considered for Day-ahead or hour ahead.
   - Will integrate SOC in Look Ahead SCED project design.

4.  **What services could storage participate in as a "Load"?**

    – Non-Spinning Reserve

    – Responsive Reserve

    – Regulation Down Service

5.  **What services could storage participate in as a "Generation Resource"?**

    – Regulation Up Service

    – Responsive Reserve

    – Non-Spinning Reserve

    – RT Energy Market

# Questions?