Columbia Energy Storage Project Update

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TMCES Workshop

July 30, 2025

Columbia Energy Storage Project

- **Team:** Alliant Energy (prime), Energy Dome, and EPRI
- **Objective:** Integrate LDES to an existing energy campus and demonstrate its feasibility
- **Solution:** 18 MW/180 MWh CO_2-based energy storage designed by Energy Dome
- **Location:** Pacific, WI near the Columbia Energy Center
- **Site Co-Owners:** Madison Gas & Electric, WEC Energy, and Alliant Energy

ENERGYDOME
Our WORLD can't wait.

Demonstrate feasibility for broader implementation

Energy Dome "CO_2 Battery"

How It Works:

A closed-loop variant on compressed air energy storage with CO_2 as the storage medium/working fluid. Heat of compression captured in thermal energy storage systems and returned to CO_2 upon discharge. CO_2 density in liquid phase allows for compact pressure vessel storage at ambient temperature. Discharged CO_2 stored in elastomeric bladder at near-atmospheric pressure.

Benefits:	Challenges:
• High efficiency • Low cost	• Requires significant footprint • Risk of CO_2 leaks

Source: Energy Dome

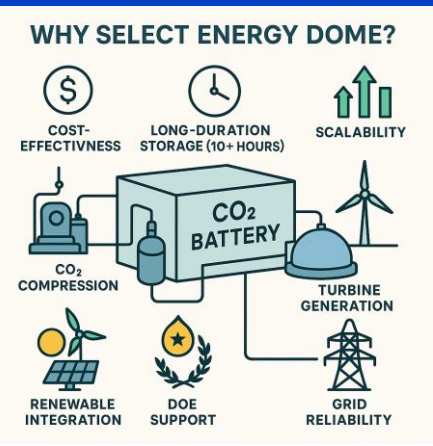
Applications:

Standalone energy storage, energy shifting, and inertia provision (charging and discharging) with 10-hour durations

Vital Statistics

Round-Trip Efficiency (RTE):	75–80%	**Technology Readiness Level:**	8
Life:	30 years	**Largest Pilot:**	18 MW / 180 MWh

Why Energy Dome?

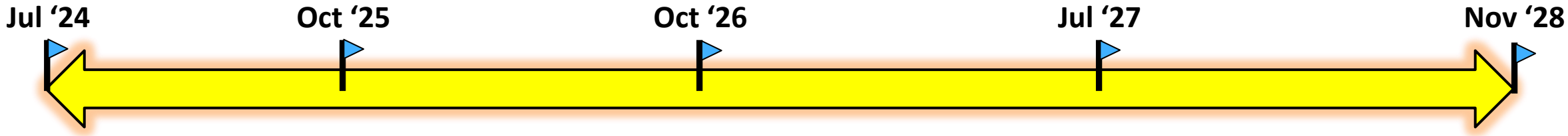


- **Cost Effectiveness:** Costs are lower than Li-ion batteries
- **High Efficiency:** RTE up to 80%, approaching batteries
- **Grid Reliability:** Alliant's goals to enhance grid stability and support renewable deployment, especially wind, requires LDES
- **Maturity:** Energy Dome's 2.5 MW / 4 MWh grid-connected pilot in Italy provided confidence
- **Simplicity:** No perceived technical roadblocks, less maintenance
- **Tech Transfer:** Energy Dome's willingness to share info and data, including through EPRI, was critical

Will be a first-of-its-kind Energy Dome system in the U.S.

Schedule

- Phase 4 end-date assumes 1-year duration (may be 2 years)
- Team is refining Phases 2–4 schedule (could change)



Phase 1: Detailed Plan	Phase 2: Develop, Permit, Finance	Phase 3: Install, Integrate, Construct	Phase 4: Ramp Up and Operate
▪ Class 3 costs ▪ Design (30%) ▪ Draft risks, safety, and cybersecurity ▪ Financial model ▪ Identified supply chain	▪ Confirmed finances ▪ Class 1 costs ▪ Design (90%) ▪ Final risks, safety, and cybersecurity ▪ Order long-lead items ▪ Permits in place	▪ Final procurement ▪ Construction ▪ Commissioning ▪ Safety and security reporting ▪ Verification and validation plan	▪ Operations ▪ Performance testing and assessment ▪ Safety and security reporting ▪ Revised growth plan ▪ Final reporting

6-year project plan with key tasks shown

Energy Dome Schematic

Core components:

- CO_2 compressor
- CO_2 dome
- CO_2 liquid storage tanks (above ground)
- CO_2 turbine / generator
- Condenser / evaporator
- Thermal energy storage
- Balance of plant

Simple design, utilizing primarily off-the-shelf components

EPRI's Role

- **Industry Collaboration:** Development of an Industry Advisory Group, which will meet twice per year (first meeting is in August)
- **Technical Reviews:** Costs, life-cycle assessment, risks, performance modeling, and safety
- **Technology Readiness Level Assessment:** Performed by EPRI
- **Tech Transfer:** Presentations at selected conferences and white papers
- **Test Plan:** Test plan will be developed for both onsite and off-site performance testing. Protocols will be created using ASME PTC 53 as a guide.
- **Performance Testing:** Onsite performance testing performed three times. Off-site reviews of performance will also be done monthly.

Goal is to provide independent assessments and collaboration

Project Update

- **Significant Milestone:** Project was approved by the Public Service Commission of Wisconsin on June 30, 2025
- **Winterization Design:** Heat tracing, roofing for power block, updated dome material / rating for wind and cold, and setback of equipment → shows Energy Dome can be installed anywhere
- **Phase 1 in Final Stages of Completion:** Design and costs are completed and component supply identified
- **Commercial Pilot Visit:** Alliant visited the Ottana site in June to review the design and operations. EPRI visit will occur in August.

Project has moved rapidly, accelerating its timeline

Field Review by Alliant Energy

Alliant Energy at the Energy Dome Ottana site

Summary

Overview

- Alliant Energy team is building a commercial-scale 180 MWh Energy Dome system in Wisconsin

Technology

- Energy Dome selected from other LDES candidates
- Energy Dome will discuss the Ottana site in more detail tomorrow

Status

- Project began in 2023 with planned commercial operation date in Q3 2027
- Phase 1 of the project is nearing completion

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