

Grid-scale energy storage



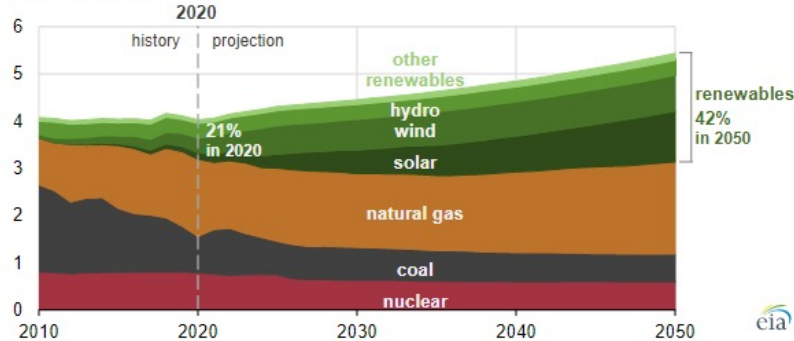
Pumped Thermal Energy Storage (PTES)

Low-cost, safe and environmentally-responsible electrical energy storage anywhere

Zero-carbon requires low-cost long-duration energy storage

Increasing penetration of intermittent renewable generation...

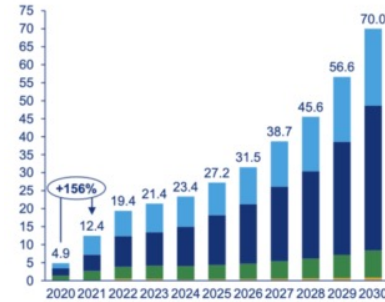
U.S. electricity generation, AEO2021 Reference case (2010–2050)
trillion kilowatthours



China and the US drive global energy storage growth

Massive wind and solar deployments will necessitate mass adoption of energy storage as a balancing asset

Global energy storage annual capacity, GWh



Global energy storage annual capacity, GWh



Americas Asia Pacific Europe MEARC

Source: Wood Mackenzie

Leads to massive growth in energy storage requirements, especially at longer durations (>4-6 hours)

Echogen's Pumped Thermal Energy Storage (PTES)

Leveraging 14 years of power cycle development and IP in an energy storage system that is:

Low Cost

Efficient

Geographically Flexible

Scalable

Sustainable



Pumped Thermal Energy Storage: Electricity stored as heat & cold

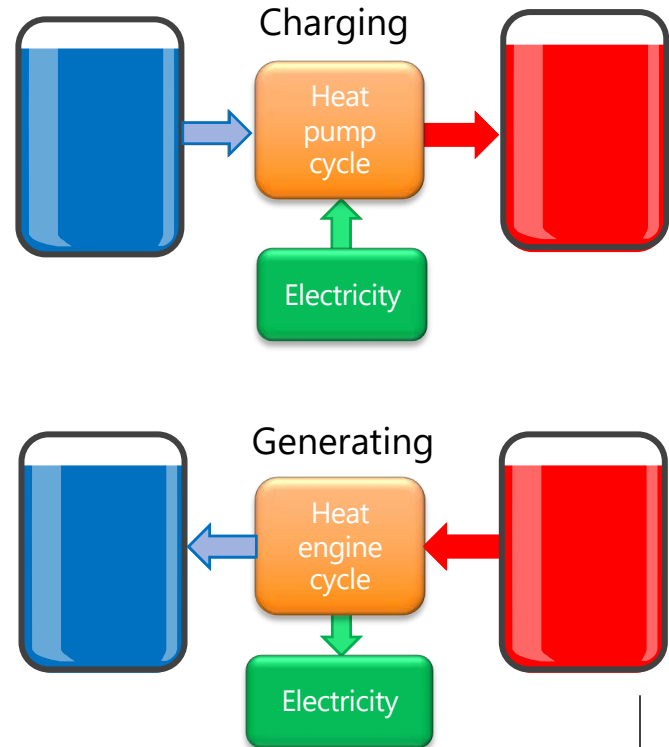
Thermodynamic cycles transform energy between electricity and heat

Charging cycle

- Electrical power moves heat from a cold reservoir to a hot reservoir

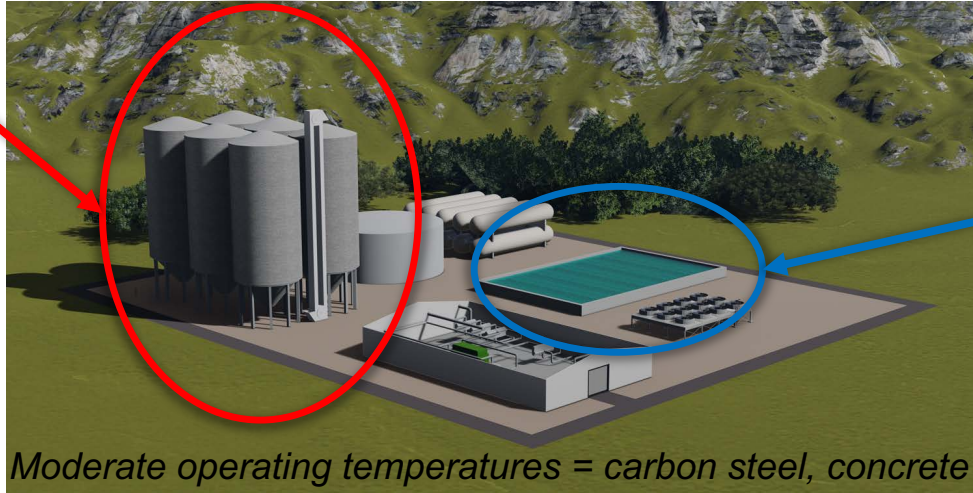
Generating cycle

- Uses heat stored in hot reservoir to generate electrical power



Material selection key to cost, sustainability, strategic goals

*Hot reservoir =
conventional sand*

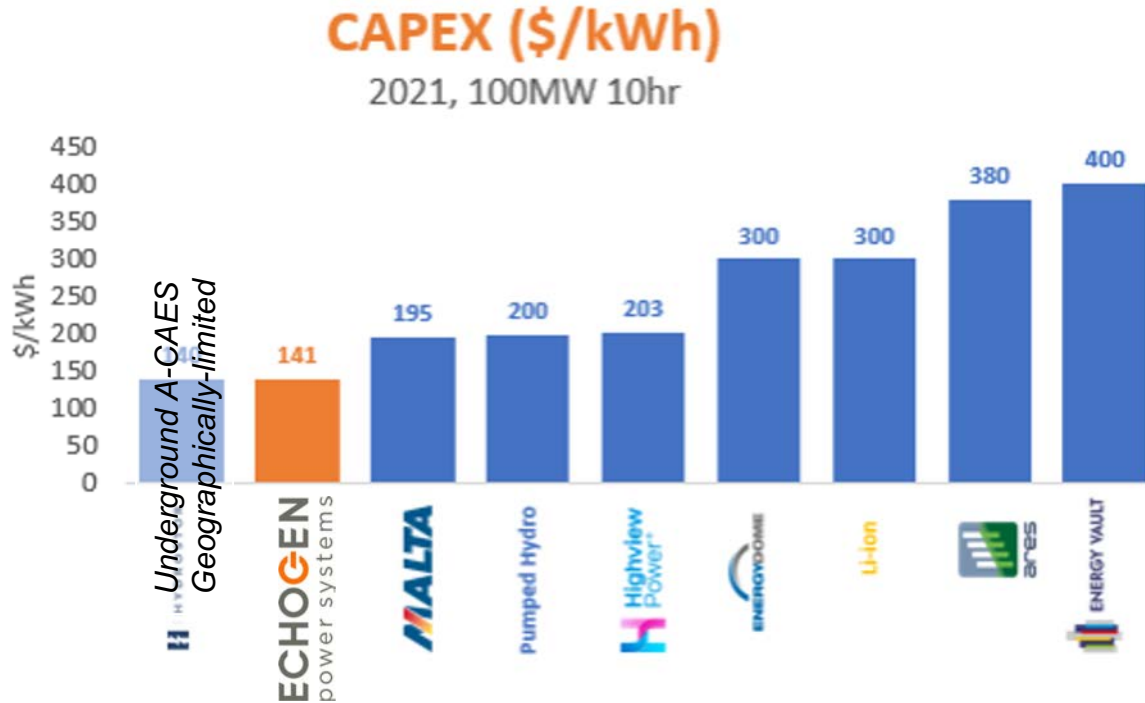


*Cold reservoir =
water/ice mixture*

Moderate operating temperatures = carbon steel, concrete

Echogen PTES system design uses materials that are: safe, low cost, environmentally sustainable, recyclable, domestically-available

Echogen's PTES yields class-leading LDES system capex



From Concept to Prototype: ARPA-E DAYS Program

~200 kWth system, including both charging and generating cycles



Low-Temperature Reservoir (LTR)



CO₂ heat pump
& power cycle

High-Temperature Reservoir (HTR)



Fundamental operating principles and system performance demonstrated

IP Portfolio and strategy



Strong IP portfolio inherited from legacy power cycle technology, supplemented by new filings specific to LDES

89

Issued patents
38 in the US

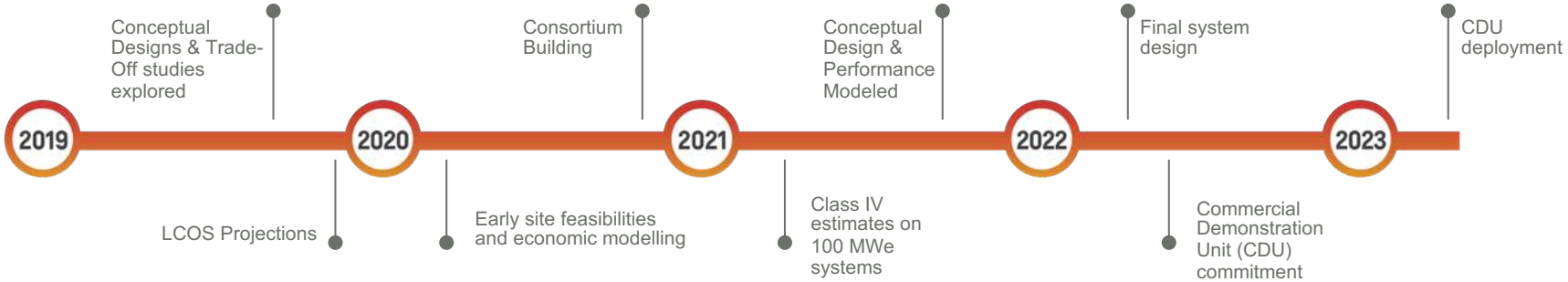
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Pending patents
19 in the US

- Cycle-level
- Operation and control
- Component

PTES demonstration timeline & Project pipeline development

**Pre-2019:
Echogen develops
core power cycle
technology**



PIPELINE

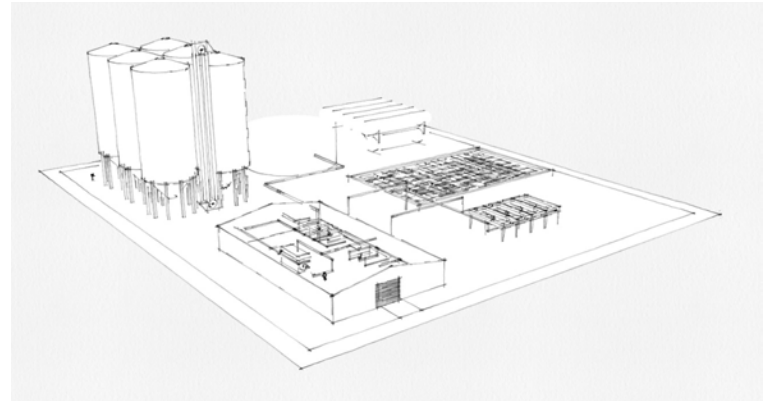
Current: 6 Projects in the pipeline

Goal: 5+ GWhrs pipeline in late-stage negotiations by Q4 2022 for deployments through 2025

KEY PARTNERS

The Ask

- \$95MM invested in Echogen power cycle and LDES technology to date
- Commercial demonstration unit (25 MWe, 10-hour) design through preliminary stage
- Potential host sites identified
- Pursuing mix of equity, non-dilutive financing to expand company, complete CDU
- Current round \$15 MM in equity raise, plan to close within 3 to 4-month time frame





Thank you! For more information:

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