2024 Commissioning of a Cost Effective “Underground Battery” in Texas

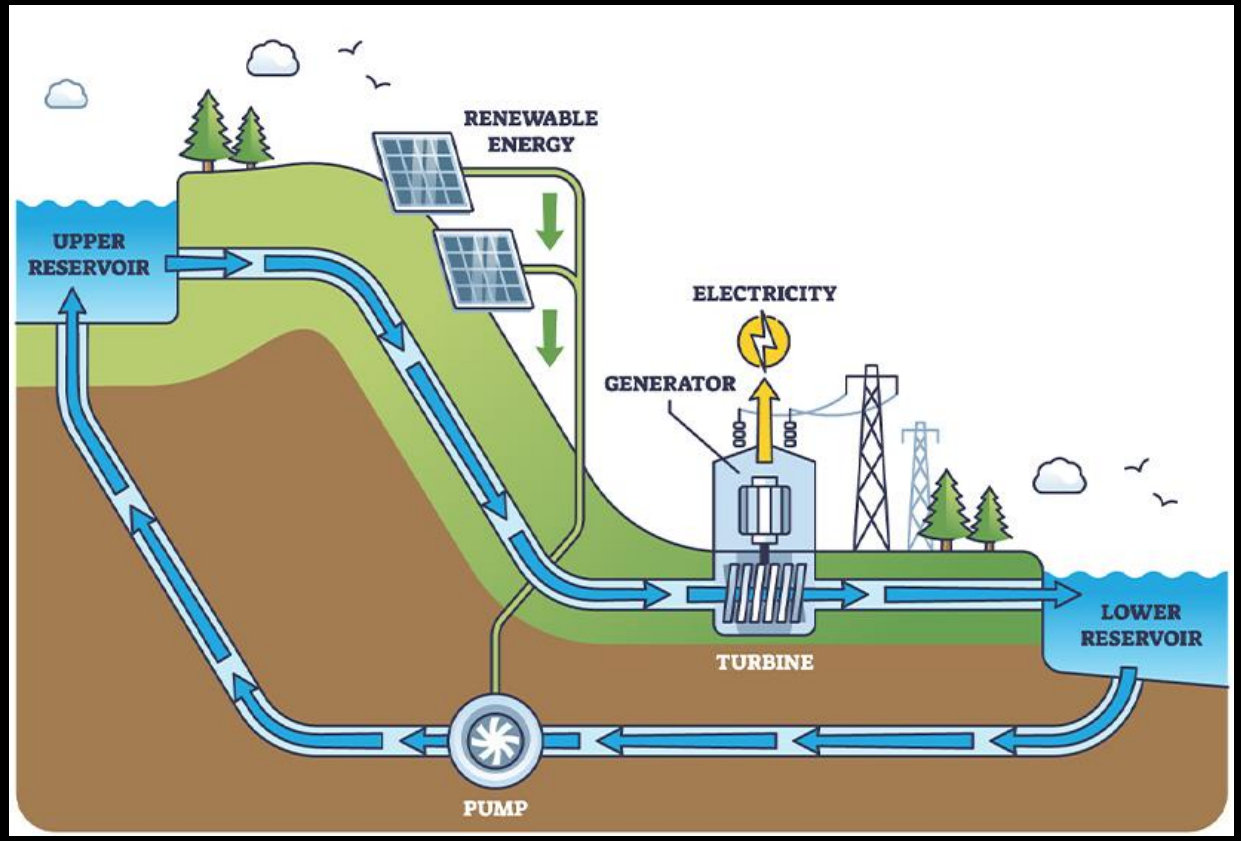
Cindy Taff, Sage Geosystems

Comparison to Pumped Storage Hydropower (PSH)

Comparison to Pumped Storage Hydropower

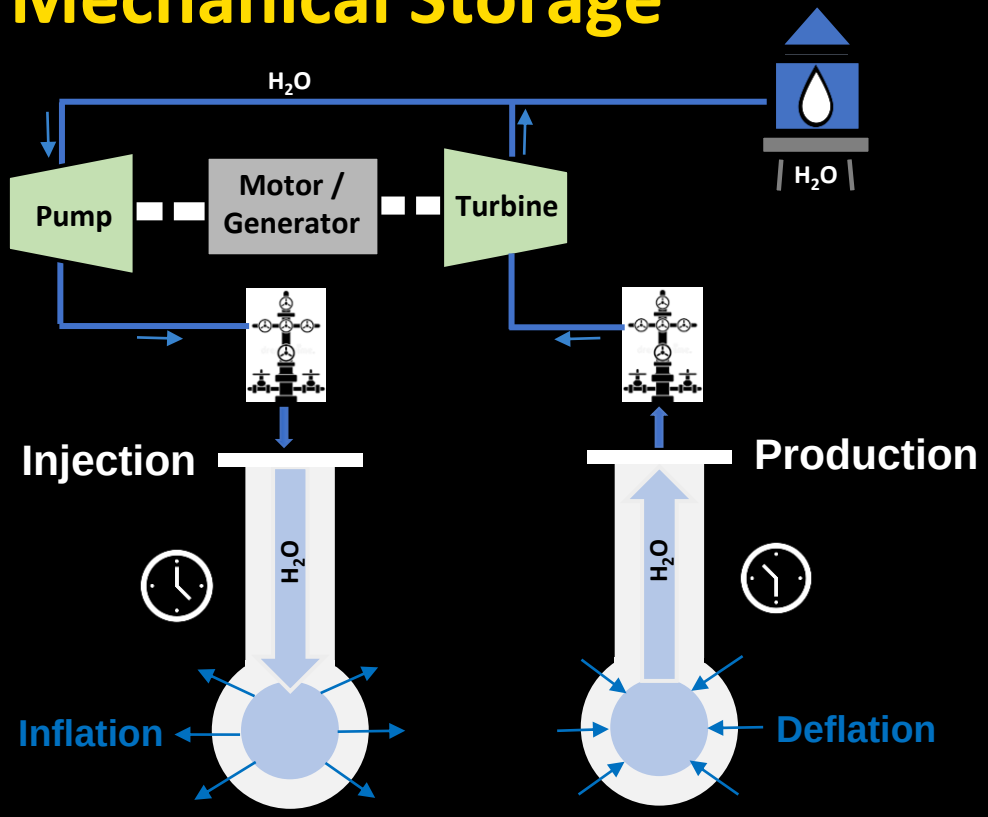
(PSH is 90+% of current storage around the world)

- **Ability to scale < 100MW**
- **Not geographically limited to mountainous areas**
- **Smaller footprint**
- **Higher energy density**
- **Weeks versus decades to permit**
- **Cost-competitive at scale**



How Does Energy Storage Work?

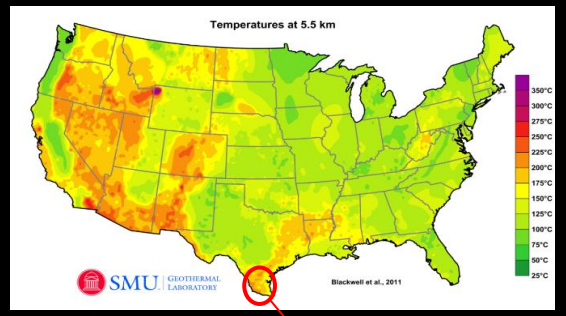
Mechanical Storage



Harvesting *pressure*
70-75% RTE
3MW per well
< 2% fluid losses

- Pumps on the surface use electricity to inject water downhole under pressure
- During the production cycle, valves are opened, and the water is released back to surface under considerable pressure which spins a Pelton turbine and generates electricity
- Can easily be designed for short-duration (3-4 hours) or long-duration (18+ hours)
- Short-duration design is best suited for load shifting
- Long-duration design can be paired with wind or solar to convert these green but intermittent energy sources to 24/7 baseload power

Commercial Pilot in Starr County, Texas

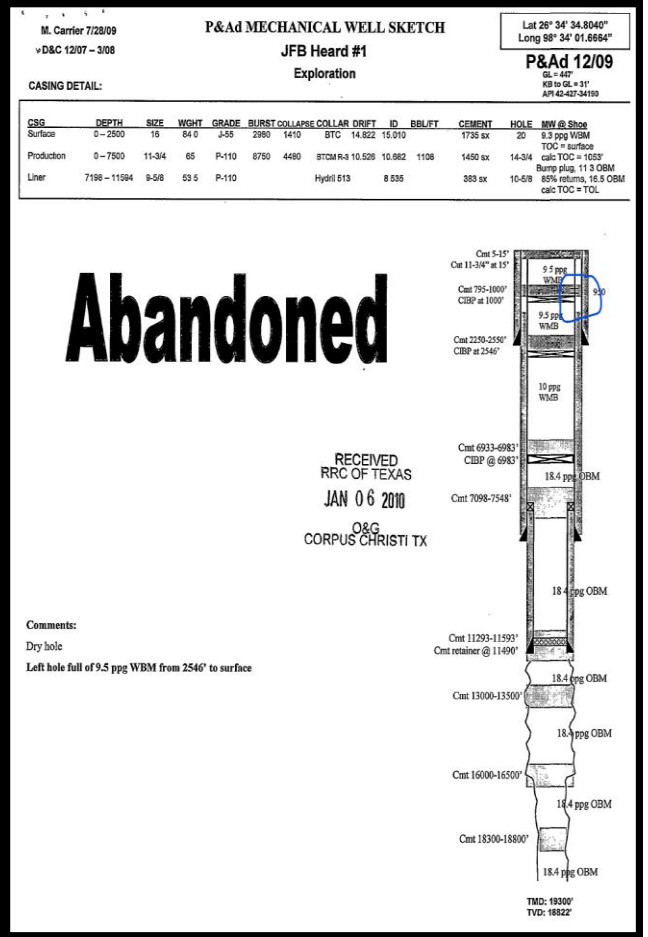


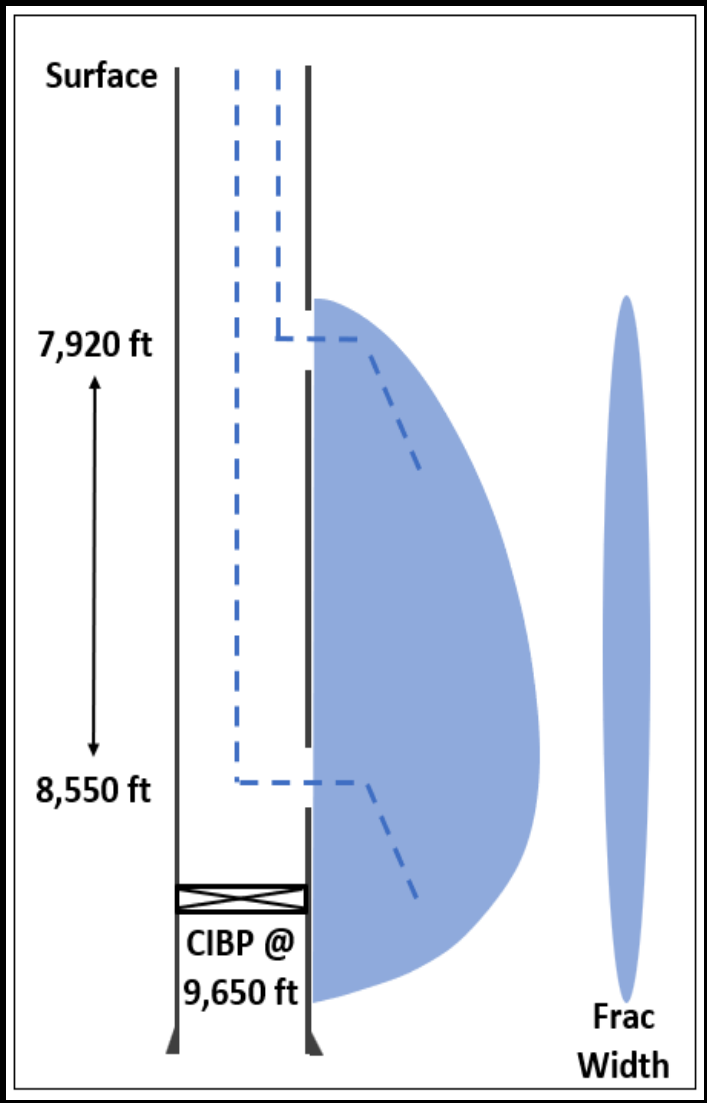
Pilot performed in Starr County, TX well

Re-enter gas exploration well

Create gravity fracture

Demonstrate technologies / generate electricity

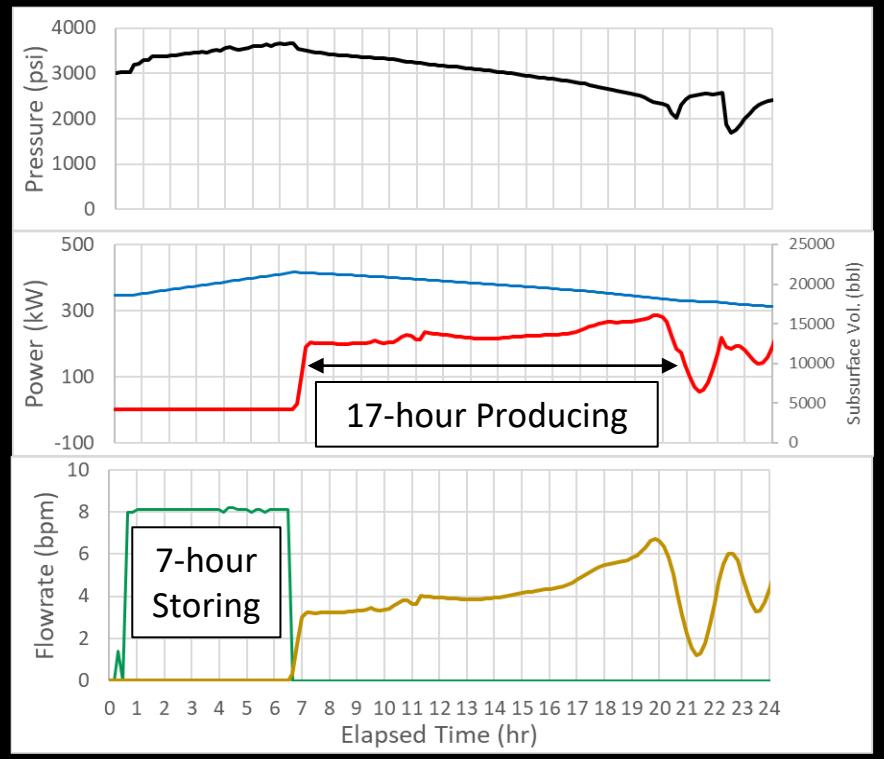




Long-Duration or Load-Following Energy Storage

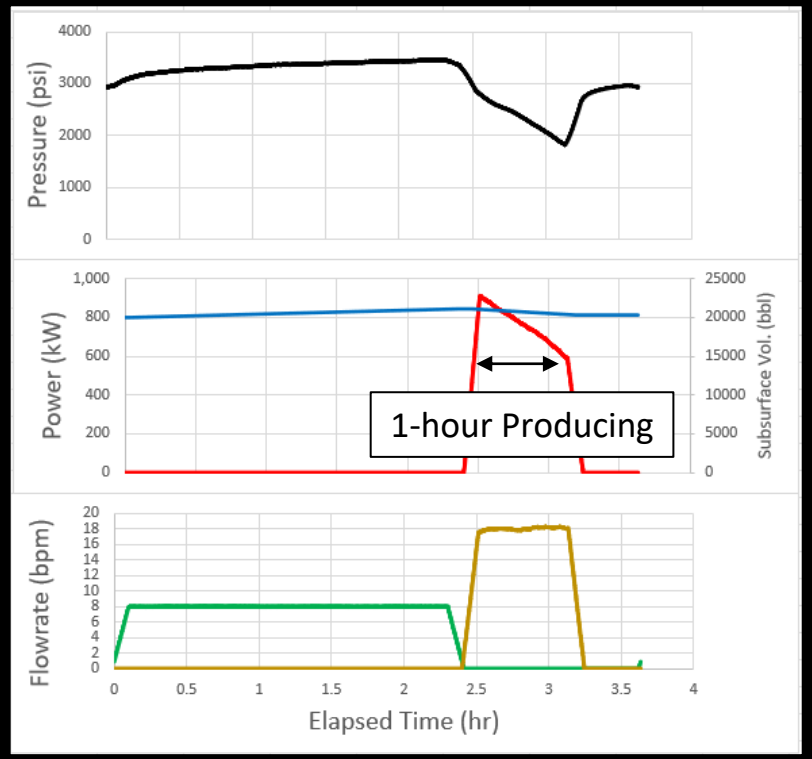
Ready to scale now - everything has been proven in the field

(Technology Readiness Level TRL7)



Long-duration

(17 hours production)

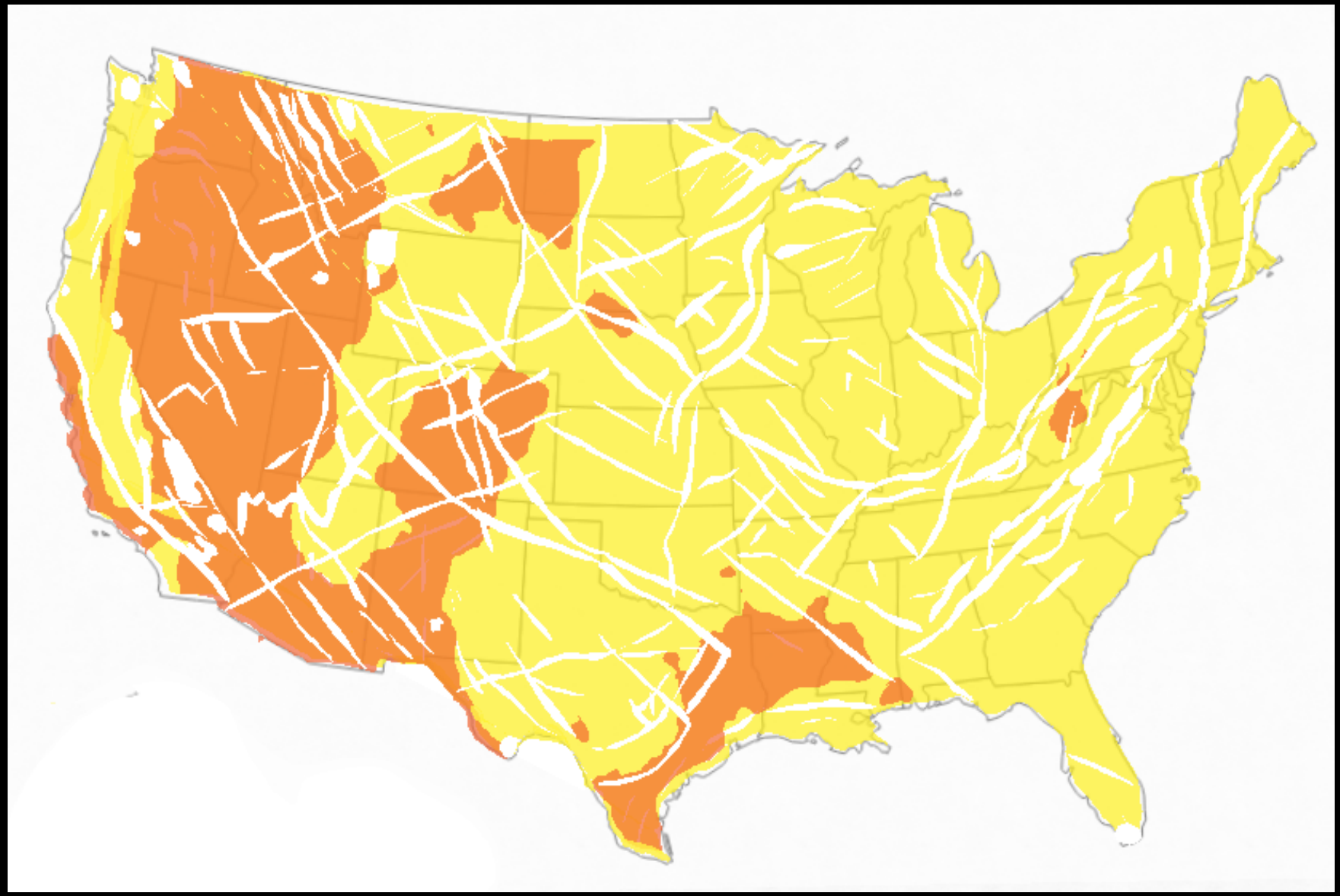


Load-following

(Release everything in one hour)

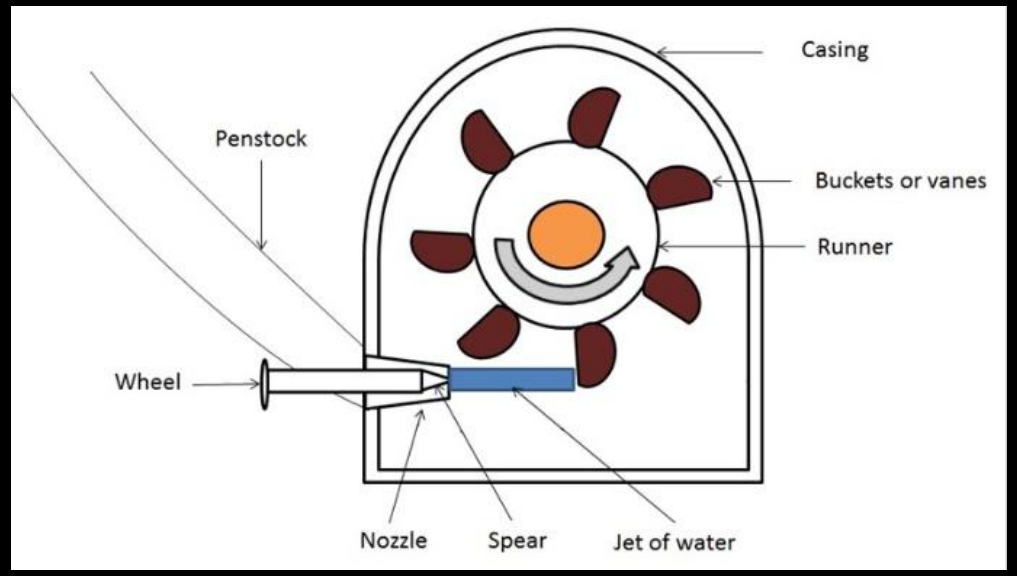
Energy Storage is Not Geographically Limited

- Energy storage (90% of U.S.)
- Geothermal (35% of U.S.)
- Major faults



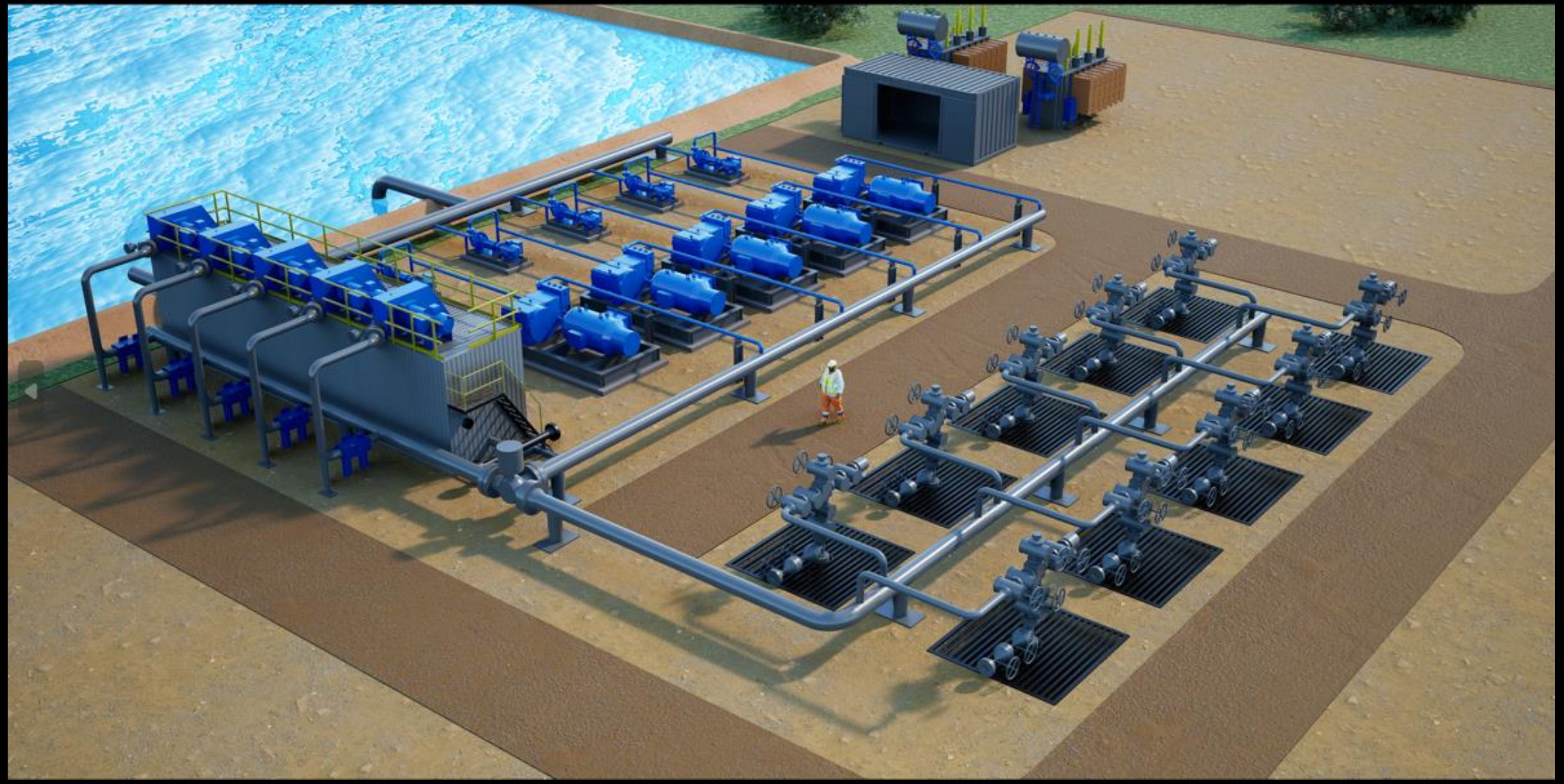
High-Pressure Pelton Turbine

Impulse water turbine invented in the 1870s by Lester Allan Pelton



- Sage is upgrading the Pelton turbine commercial design to 5,000 psi (3MW)
- Construction ongoing - delivery by October 2024
- Scale-up to 30+MW will be a techno-economic decision
  - Per well turbine design
  - Manifold flow and build larger Pelton turbines

Scale Rendering - Sage 30MW Energy Storage Facility



Sage's Mechanical Storage - Upfront Capital & LCOS

Beats Pumped Storage Hydro & Lithium-ion batteries

- Rapid payout
- IRR = 20 to 30%

Sage's EarthStore™

PRE-SCALE
$2.5-3.5mln per MW
(Any Duration)

LCOS = $0.03-0.04/kWh

> 50MW SCALE
$2.0-2.7mln per MW
(Any Duration)

LCOS = $0.02-0.03/kWh

PSH

$2.6mln per MW
(Long Duration)

LCOS* = $0.06-0.18/kWh

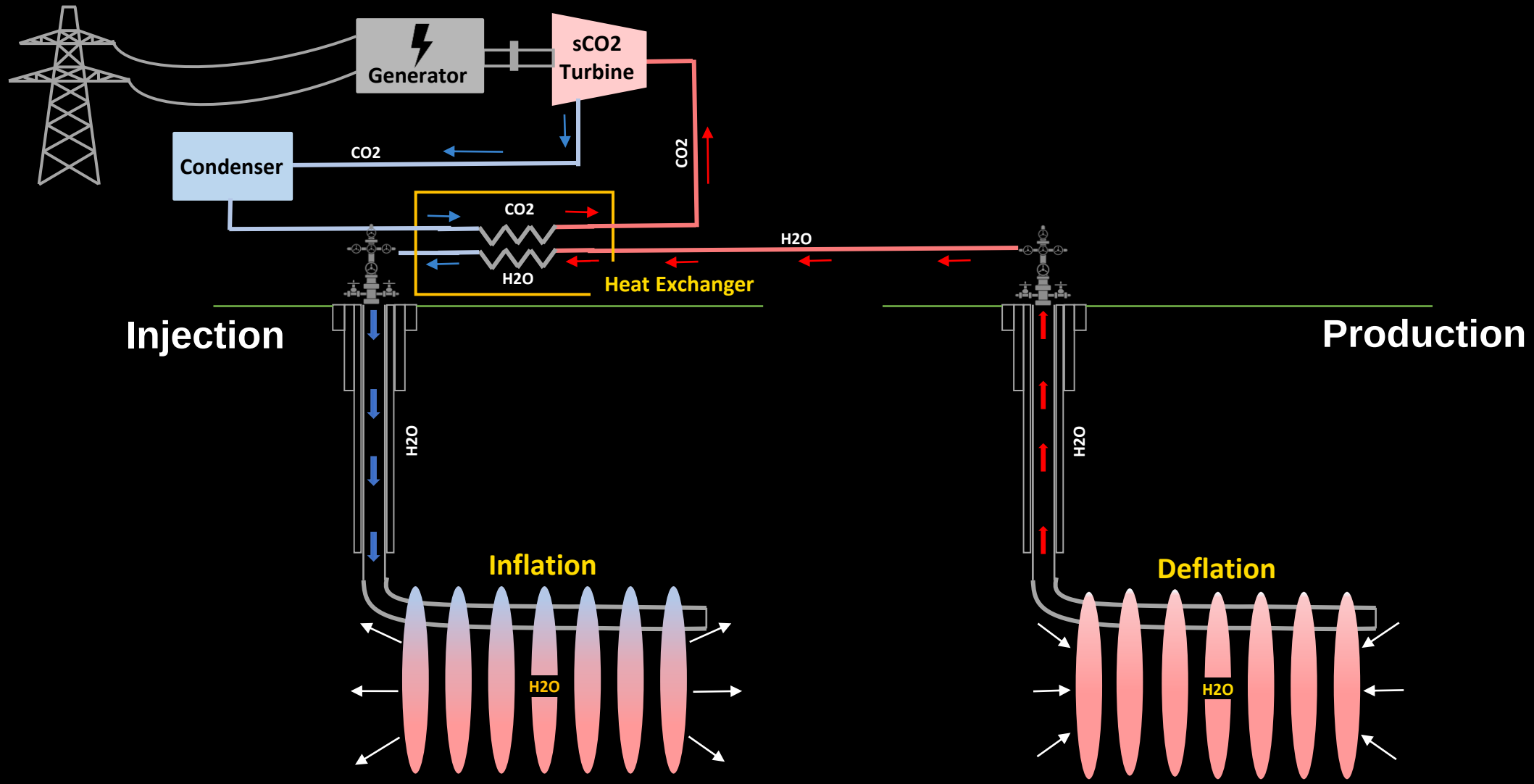
Lithium-ion batteries

$3mln per MW
(Duration < 4 hrs)

LCOS* = $0.25-0.30/kWh

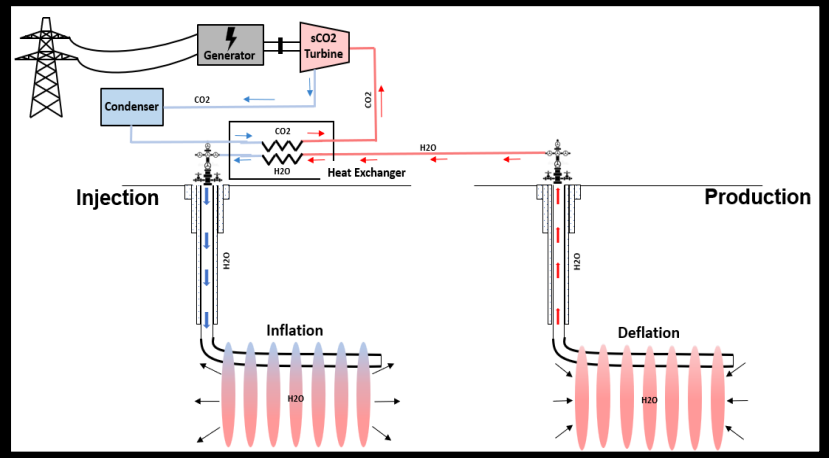
*Navigant Research 2Q 2019 – Comparing the Costs of Long Duration Energy Storage
20190626_Long_Duration Storage_Costs.pdf (slenergystorage.com)

How Does Geopressured Geothermal System (GGS) Work?

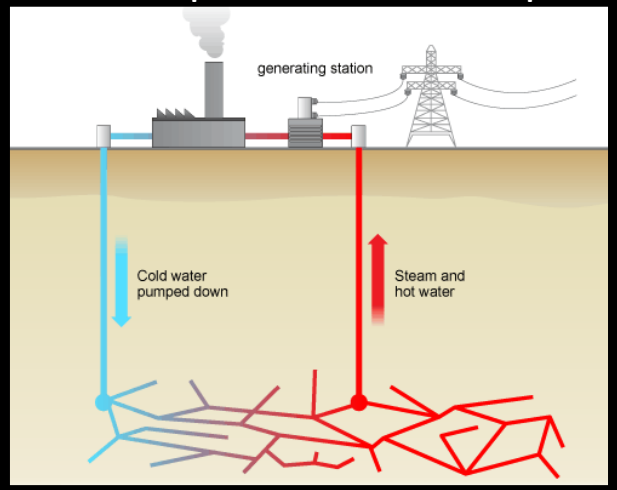


How is Sage GGS Different for New Generation Geothermal?

Sage GGS Technology - Solves challenges of EGS and delivers commercially-viable geothermal



DOE EGS Technology (since 1970s) - No commercial plants due to low net output



- Connect wells in the surface (versus subsurface)
- Operate with fractures open, meaning commercially-viable net output (low friction losses and no cold-water breakthrough from water channeling)
- Sage does not vent pressure, resulting in 25-50% more net output
- Lower risk of induced seismicity