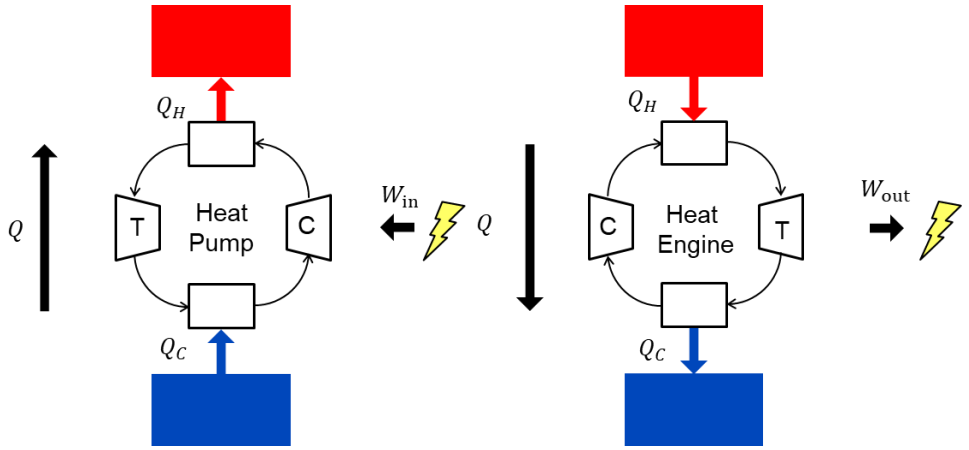
# Integration of Pumped Heat Energy Storage with a Fossil-Fired Power Plant

**Award No. DE-FE0032031**
AOI 1B, Phase 1 Feasibility Study

| | |
|---|---|
| **DOE:** | $ 199,875 |
| **Non-DOE:** | $ 50,125 |
| **Total:** | **$ 250,000** |

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Applied R&D Institution

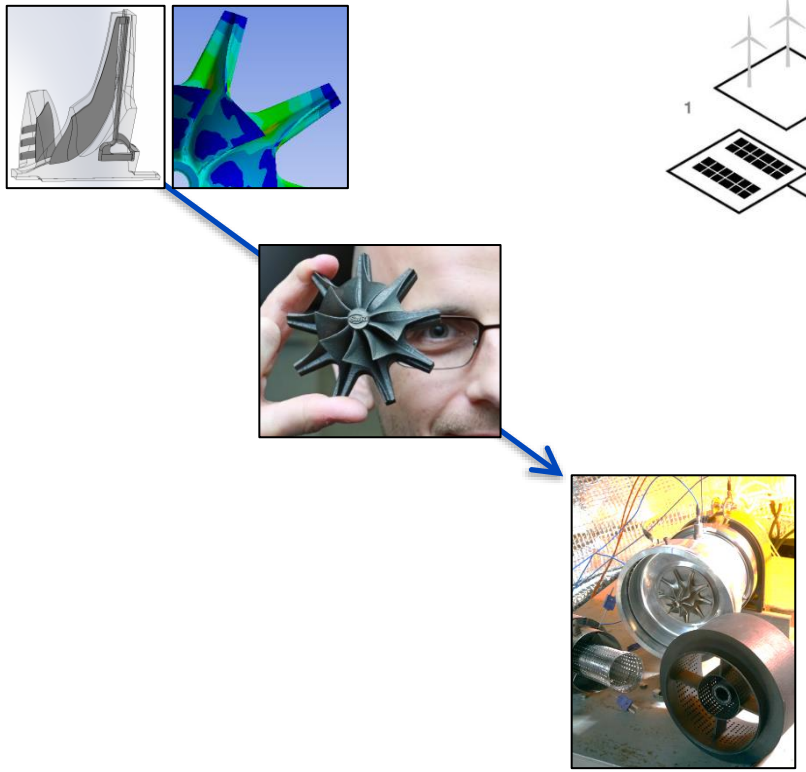
Energy Storage Developer

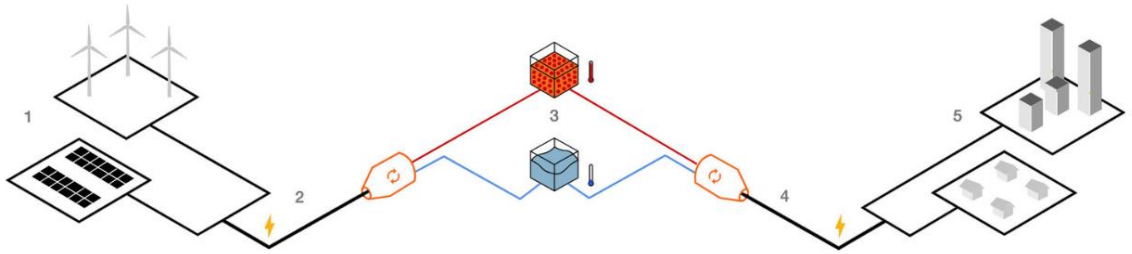
Fossil Asset Owner

*Benefiting government, industry and the public through innovative science and technology*

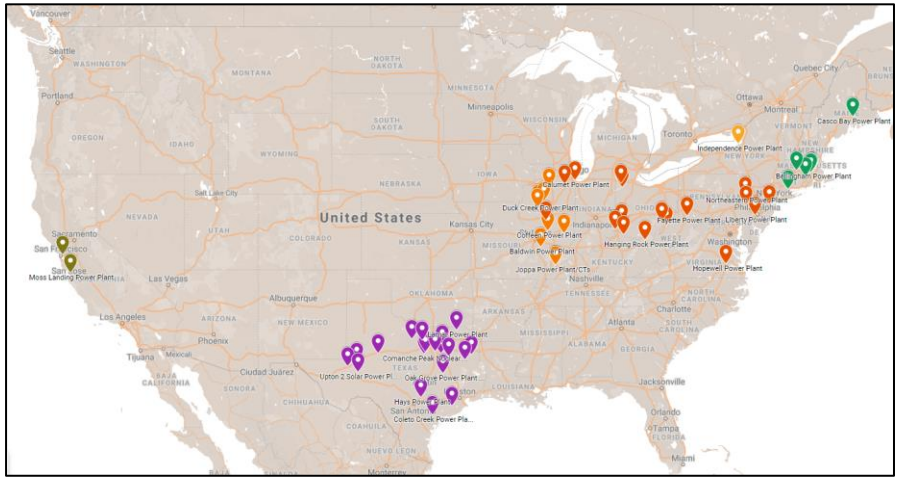
*Meet the Future of Energy Storage*

*Powered by people generating safe, reliable, and cleaner electricity for today.*






~39,000 MW of generation
across 12 states,
powered by a diverse portfolio of
natural gas, nuclear, coal, and solar facilities



# MALTA Pumped Heat Energy Storage (MPHES)

Cycle:
Simple recuperated
Air as the working fluid

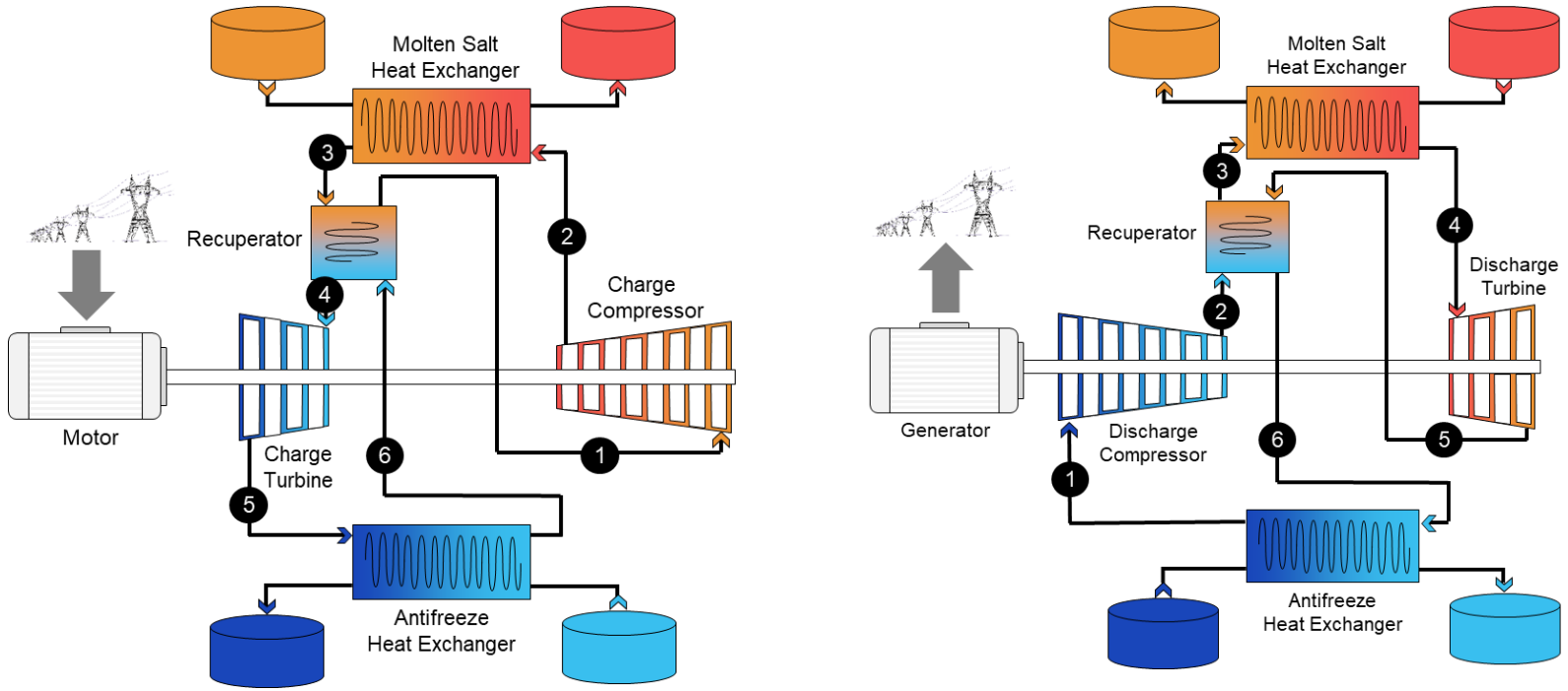
Hardware:
Two separate drivetrains
Heat exchangers shared between modes
Storage systems shared

System:
Stand-alone system
Integrates electrically with fossil-energy
Thermal integration with waste heat possible

Performance :
High round trip efficiency (60-65%)
Long lifespan (30+ years)
100 MW system
Long-duration (10+ hours)
Scalable to integrate with assets across a portfolio

**Charge Mode** **Discharge Mode**

Molten Salt at 565˚C




Antifreeze at -60˚C

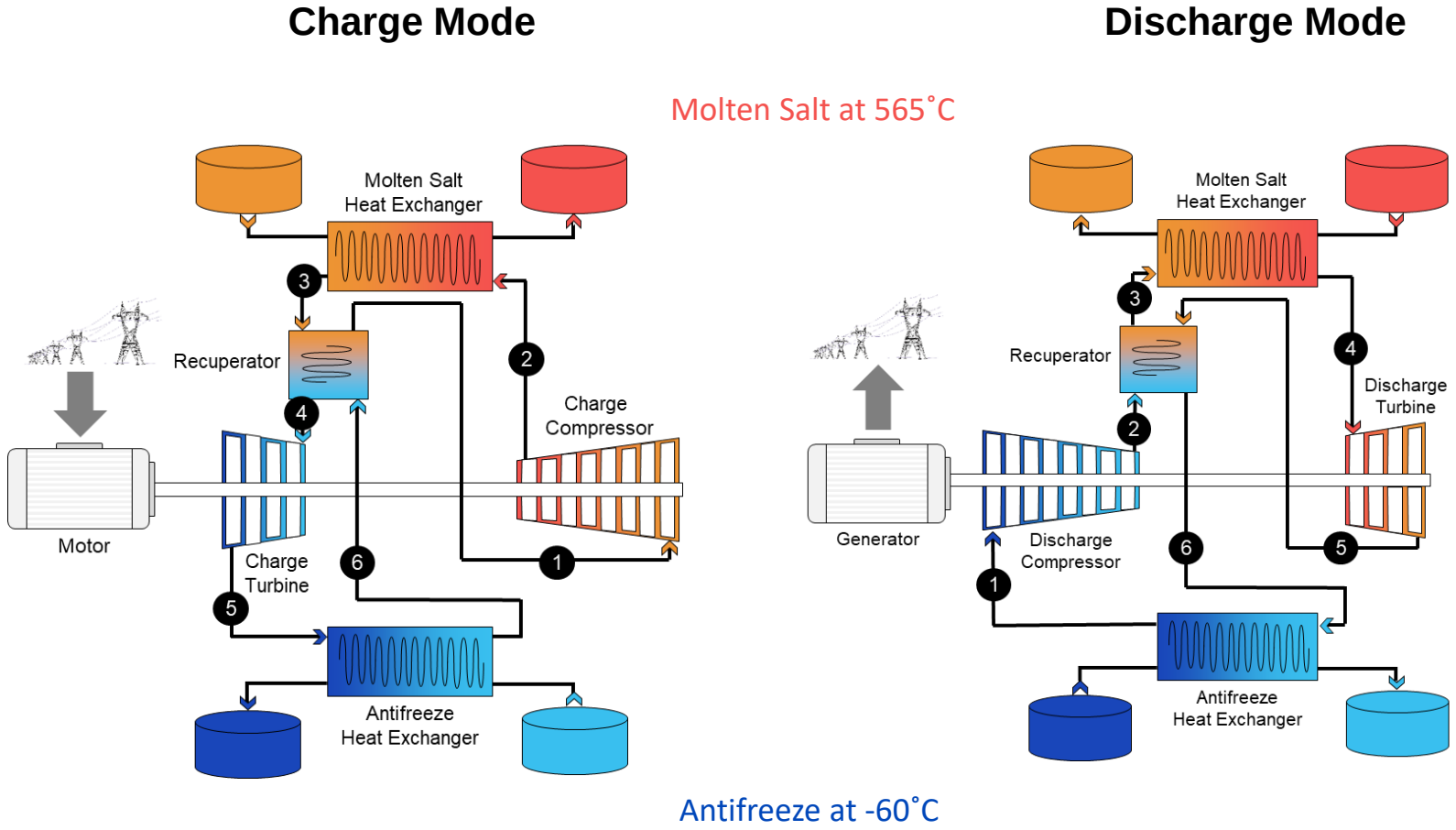
# Pumped Heat Energy Storage (MPHES)

Synergy with Fossil:
Uses hardware components, workforce personnel, and skillsets similar to those used by fossil EGUs

TRL & Development:
System leverages commercially available hardware

Laboratory-scale demonstration of a PHES system investigating control strategies and first implementation challenges of the technology (DE-AR0001018)

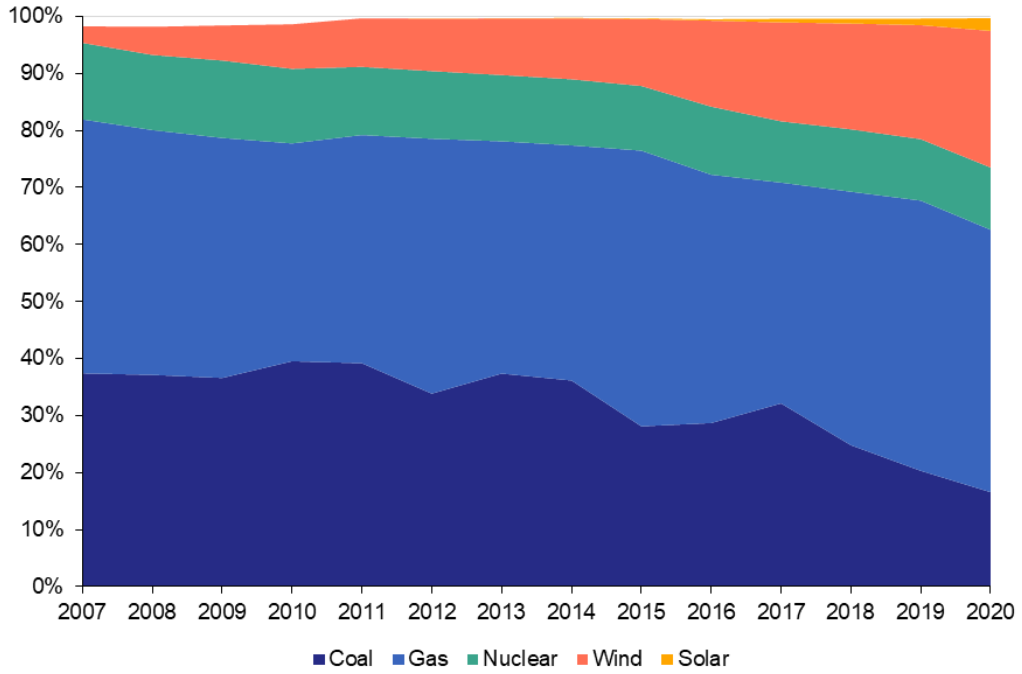
Nearly prototype technology readiness level (TRL-5), with near-term pilot demonstration



# Integration with Luminant Fossil EGU in ERCOT

**ERCOT**

- Beginning to see a significant shift in the generation mix, as of August 2020,
  - VRE makes up 26% of the ERCOT generation mix
  - Wind energy has seen continued growth
  - Solar energy has grown to a non-zero contribution
- Market with high wind penetration
  - In 2019, ramps due to wind were experienced at 12% total generation in one hour



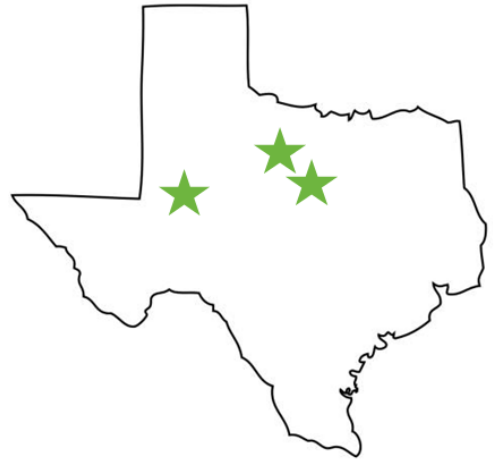

**Luminant Site Selection**

Three potential gas-fired power plants were identified during the proposal phase

- Two combined cycle natural gas plants with negative pricing at night
- A simple cycle peaker located near a variety of other assets

All based in North or West Texas where wind energy contributes to grid disturbances throughout the year

Site selection on-going as first major project task



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# Demonstrate the potential benefits of integrating MPHES with a gas-fired plant

**Improved operational performance**:
Enable gas plants to run with reduced cycling

**XX.XX %**

**Increased economic performance**:
Enable gas plants to better respond to grid disturbances

**Site Selection**

**XX.XX %**

**Improved environmental performance**:
Allow asset owners to better monitor emissions usage

**XX.XX %**

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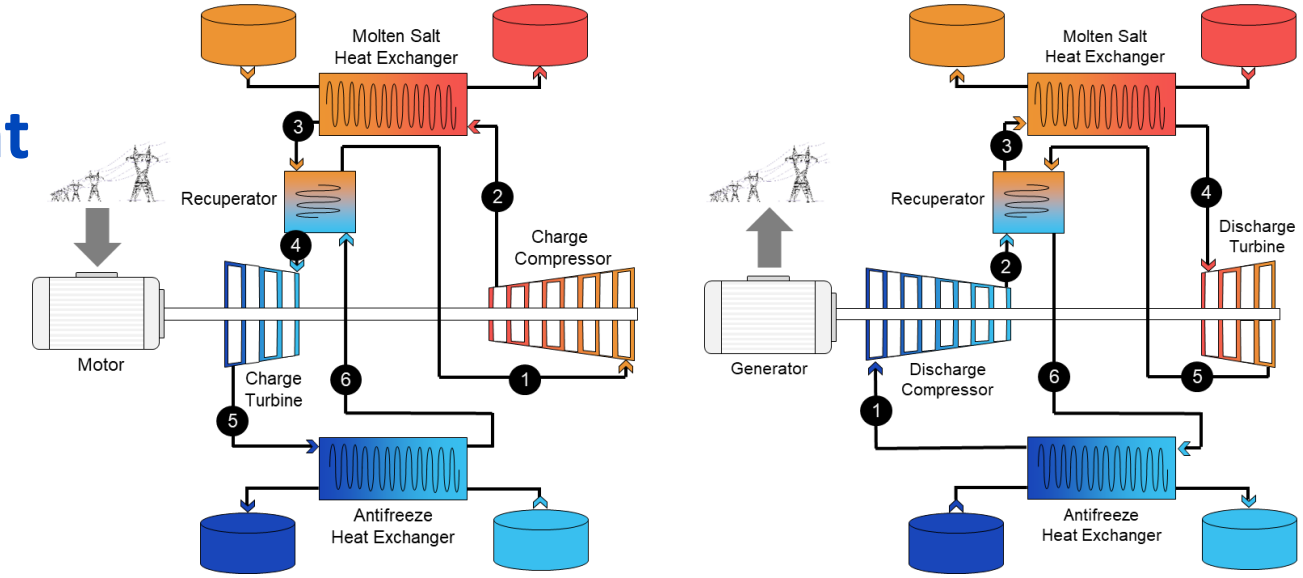


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