

ECHOGEN

ECHOGEN POWER SYSTEMS

CO₂ Pumped Thermal Energy Storage

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Echogen has developed a platform sCO₂ technology to **reduce industrial emissions** and enable the energy transition

Long-Duration Energy Storage

Pumped thermal energy storage (PTES) to enable baseload utility-scale renewable energy

Nuclear and other Primary Cycles

Advanced power conversion systems for next generation reactors, SMRs, and other thermal sources supporting reliable, low-carbon baseload and grid flexibility

Waste Heat Recovery

Skid-based solution to utilize high-temperature waste heat to produce electricity or mechanical drive. Ideal for conversion of simple cycle gas peakers, cement, steel, and other power generation applications

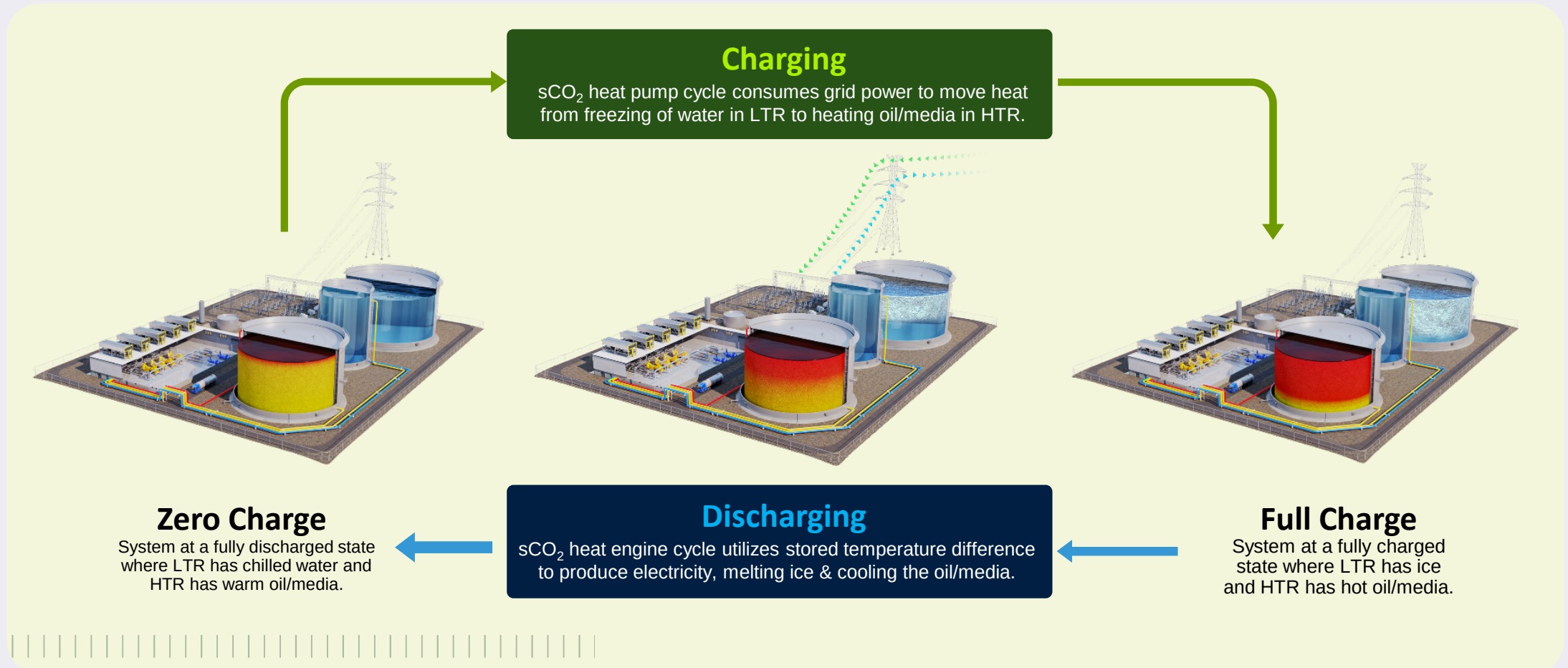
Industrial Heating

High efficiency heat pump technology to electrify low and medium temperature industrial applications



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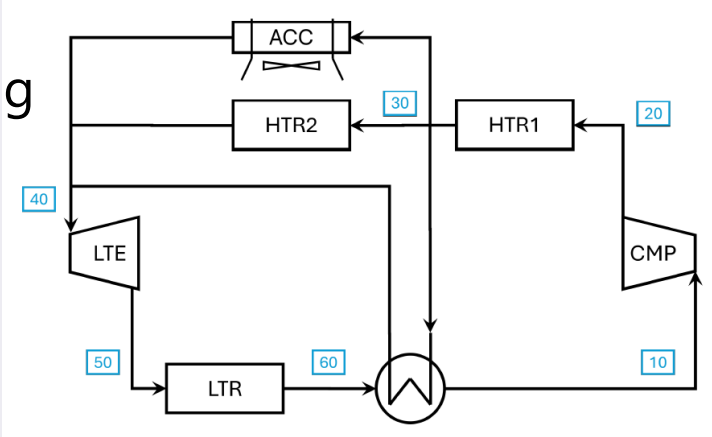
PTES - Storing electrical energy as thermal potential



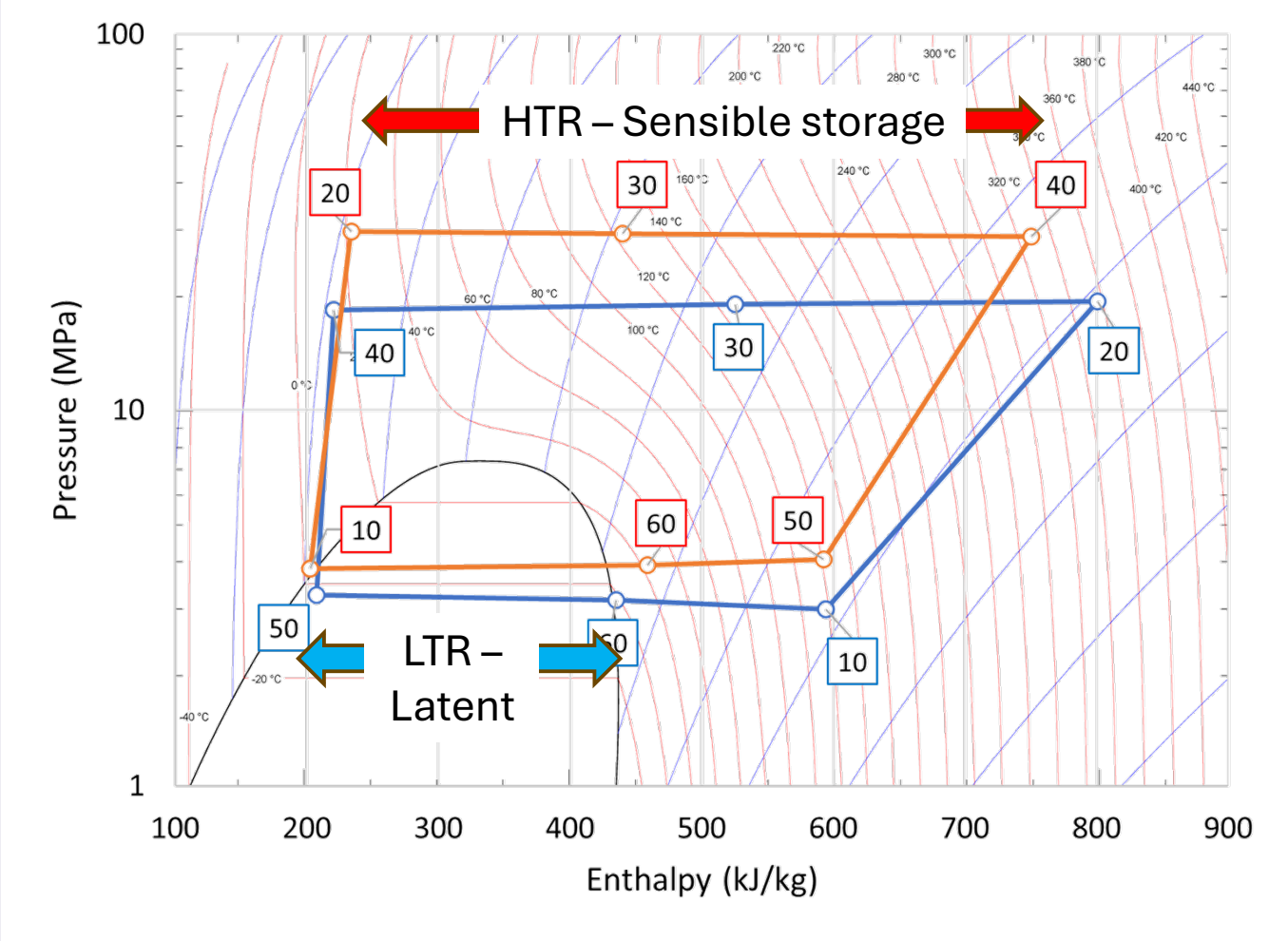
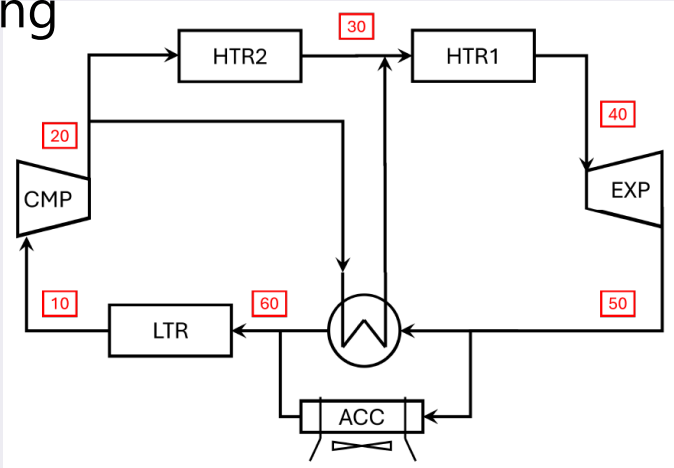
Pumped Thermal Energy Storage basics



Charging



Generating





Key characteristics – CO₂ PTES

- Performance:
 - Net RTE in 50-60% range depending on size, charge/discharge ratios, other requirements
- Flexibility:
 - Charge/discharge rates independent
 - Turndown performance, both charge & generate
 - External heat source integration – GT2026-178201
- Synchronous electrical machinery: Grid support
- Footprint: > 200 MWh/acre (500 MWh/ha)
- Safety: Low fire and EHS risks
- Low CO₂ inventory: ~ 100 tons for a 50 MW system, independent of MWh
- Cost: Competitive with Li+ at 6-8 hours, significant advantage at longer durations

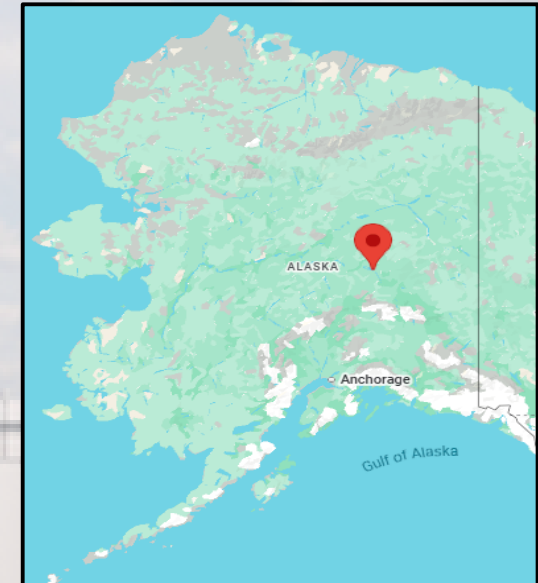
Project description

Golden Valley Electric Association (GVEA)

Located in North Pole, Alaska - 1200 MWh-e plant

CHG cycle: 25 MW with 5:1 turndown

GEN cycle: 50 MW x 24 hrs with 10:1 turndown

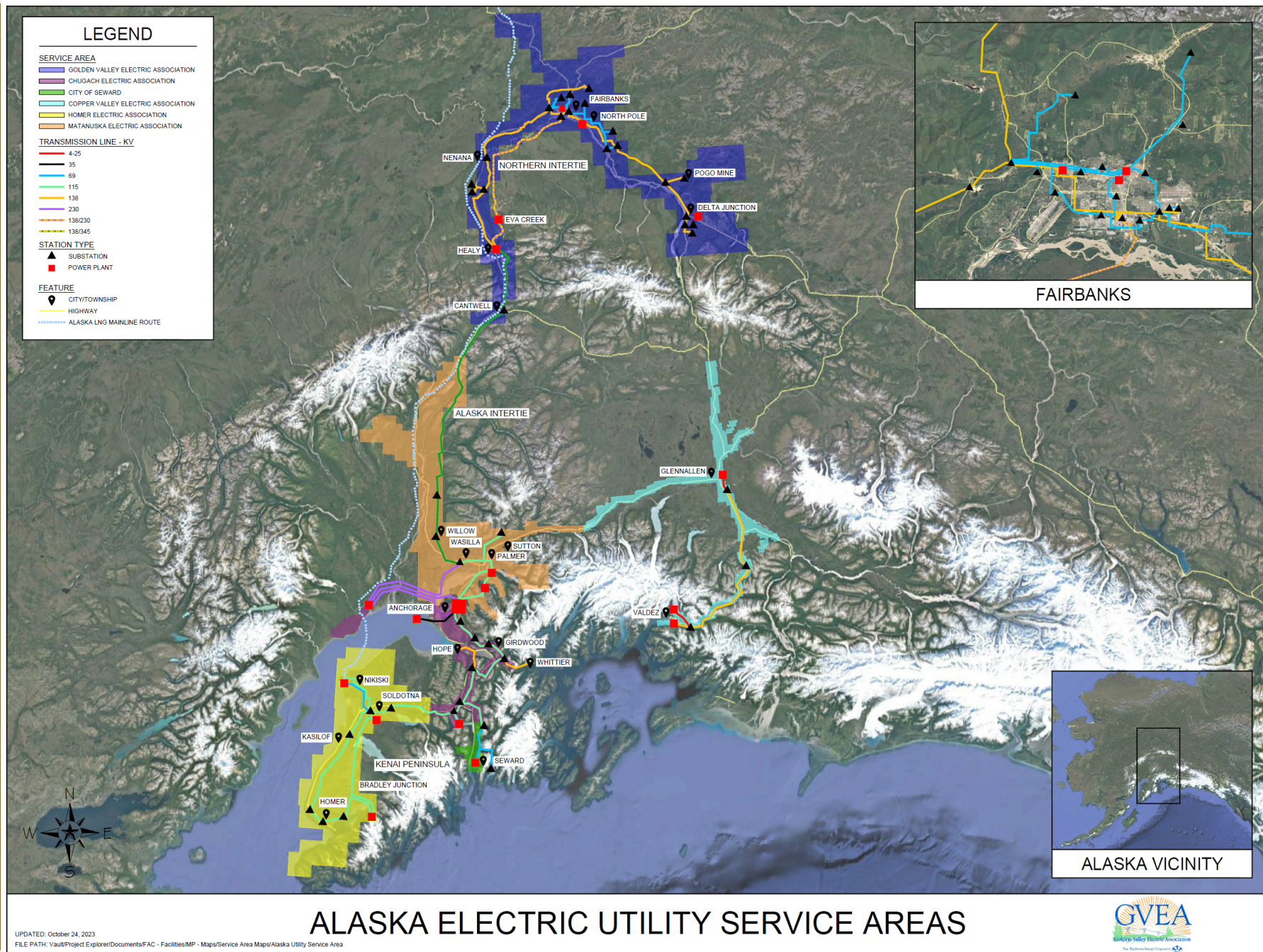


ASRC ENERGY SERVICES
a subsidiary of Arctic Slope Regional Corporation



Alaska Railbelt Overview

- **Islanded System**
 - Electrically isolated
 - No interconnections to lower 48
- **Winter-Peaking**
 - Peak demand: 751 MW
 - Installed capacity: 1826 MW
 - Reserve margin: 143%
- **Interconnection Participants**
 - Golden Valley Electric Association
 - Chugach Electric Association
 - Matanuska Electric Association
 - Homer Electric Association
- **Energy Sources**
 - Coal
 - Diesel
 - Natural Gas
 - Wind
 - Hydro



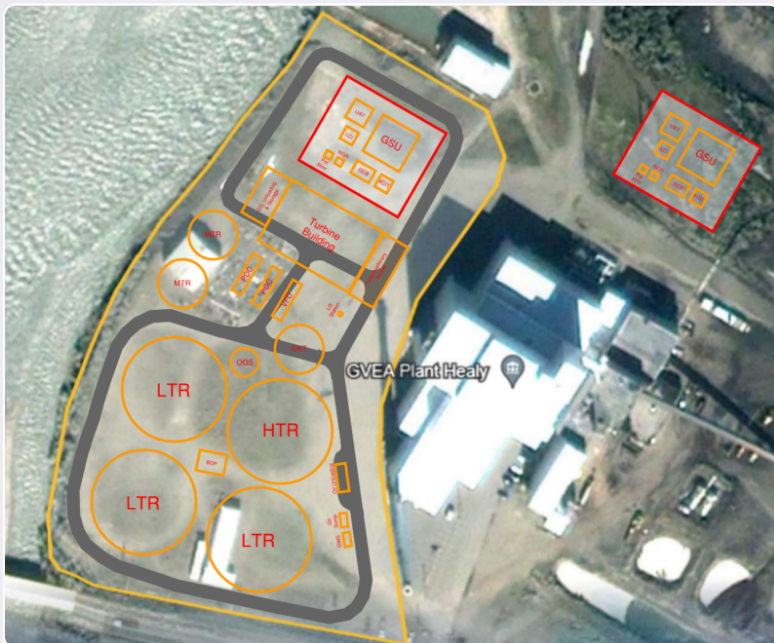


Use case development

- Initial proposal (2023) – PTES to firm/support > 100 MW of new wind generation, GVEA to decommission Healy Unit 2 (60 MW coal-burner)
- Value proposition centered on reduction in operations of ULSD-fired gas turbines
- 2024 – GVEA defers new wind generation and Healy Unity 2 retirement
- 2025-2026 – Railbelt Council continuing to explore generation and LDES strategies to meet long-term power reliability and affordability challenges



Commercial deployment activity



- Alaska 50 MW/24 hour LDES project, partially DOE funded
- Project formally retained by the DOE
- Final updated use case modeling underway
- Start of detailed engineering and long lead procurement Q4 2026
- Announced project in Slovakia continues to move through regulatory milestones and toward engineering kickoff in Q4 2026
- Expect additional project announcements including one international and one supporting a hyperscaler customer



LTR cost reduction – SCW vs IOC

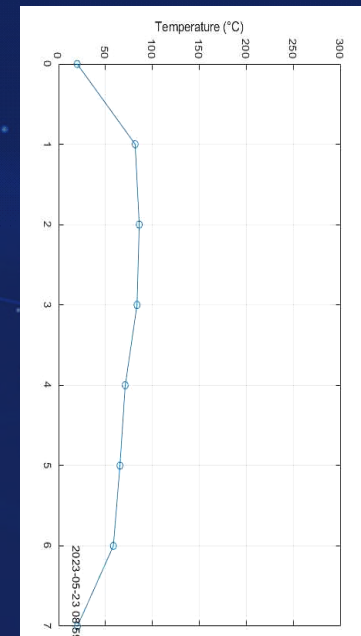
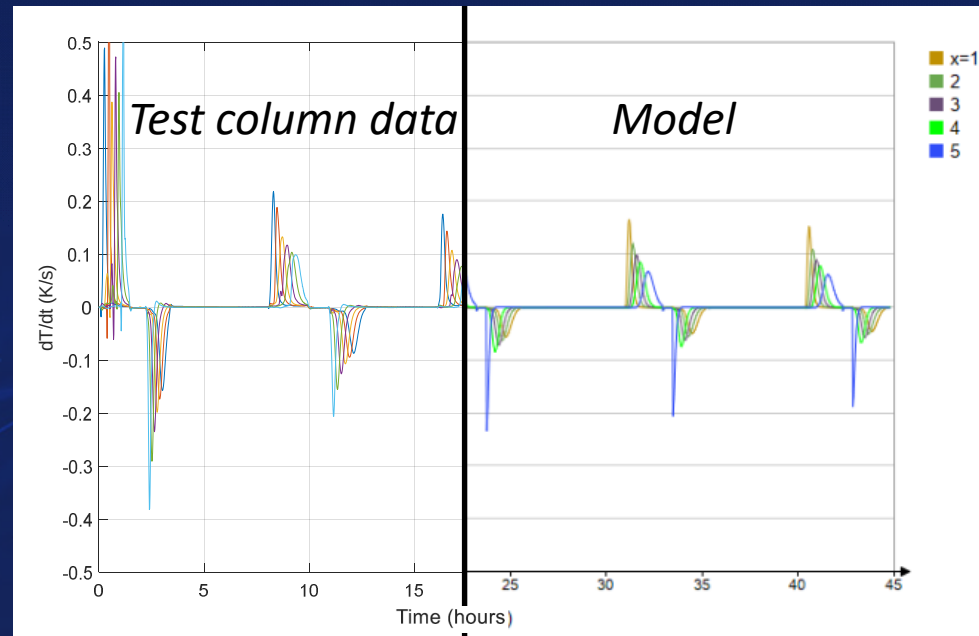
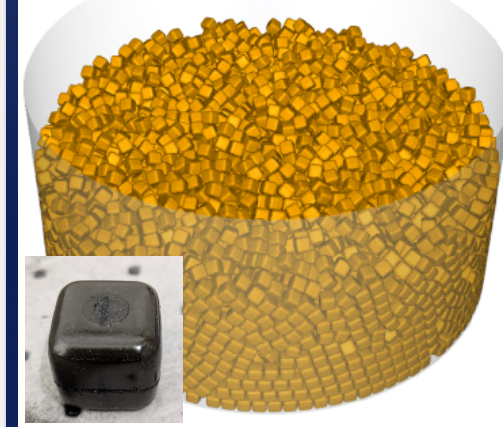
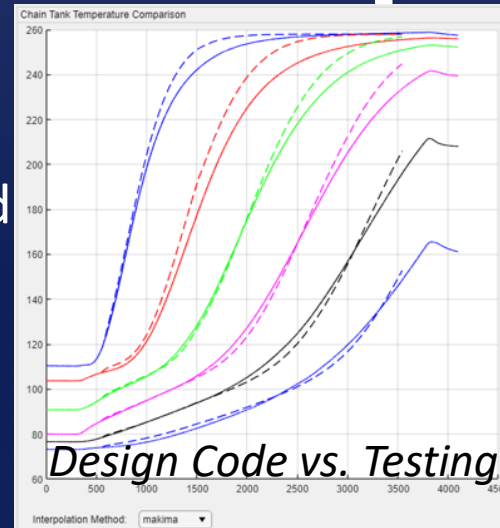
- Supercooled water ice/water slurry generation > 40% cost reduction relative to IOC, larger at longer storage duration



HTR developments

Packed Bed + Heat Transfer Fluid

- Westinghouse proprietary engineered concrete fill
- Testing of thermal column
 - Multiple fill materials tested
 - Simulation tools validated against data
- Active test & simulation programs
 - Packing fraction + DEM* simulation program
 - Durability (cycle) testing
 - Manufacturing automation
 - Integrated effects (large-scale) test
- Longer-term cost reduction activities
 - Up to ~40% reduction possible with advanced materials



Integrated System Test & controls dev

RCX &
DEH



Compressor



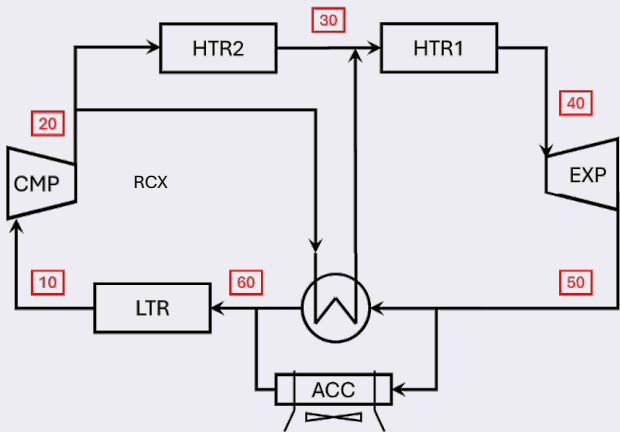
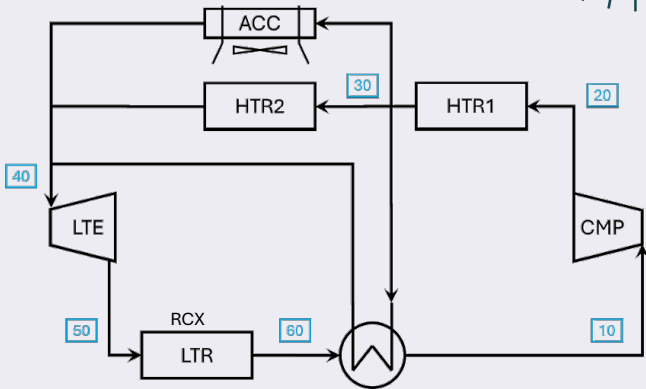
Pump



HTR

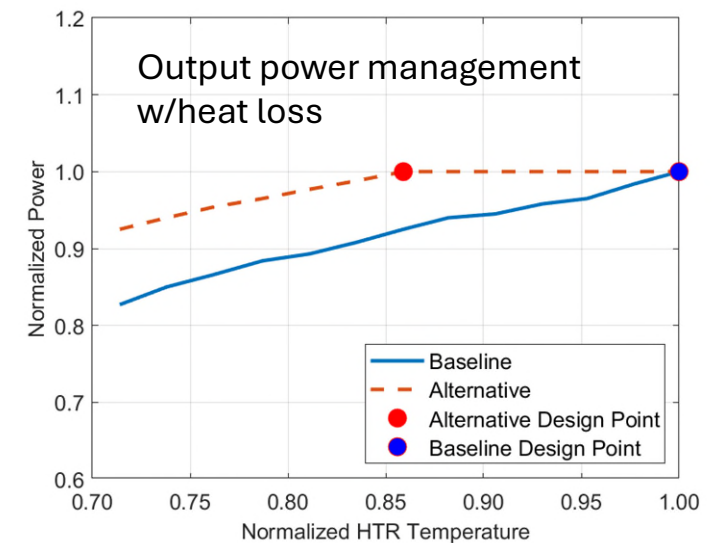
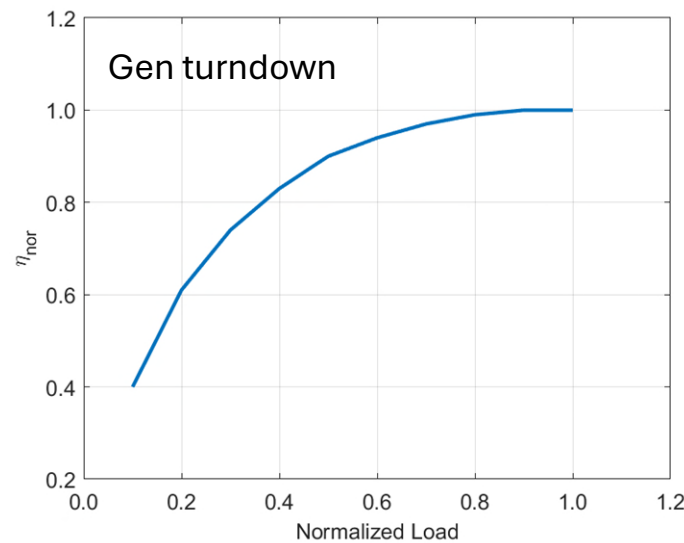
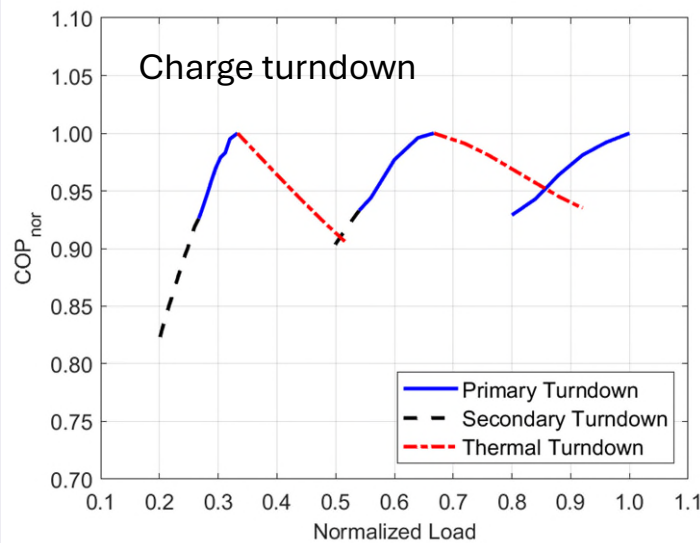
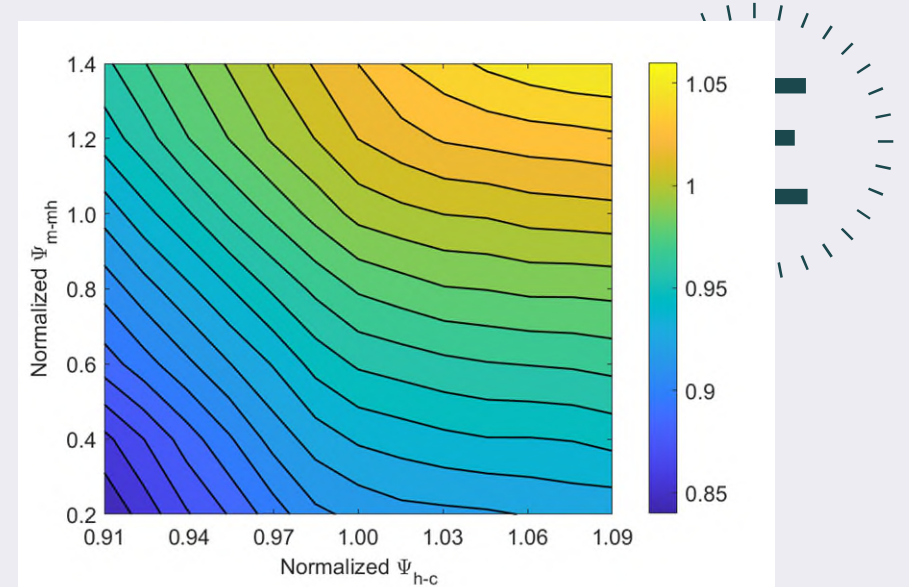


LTR

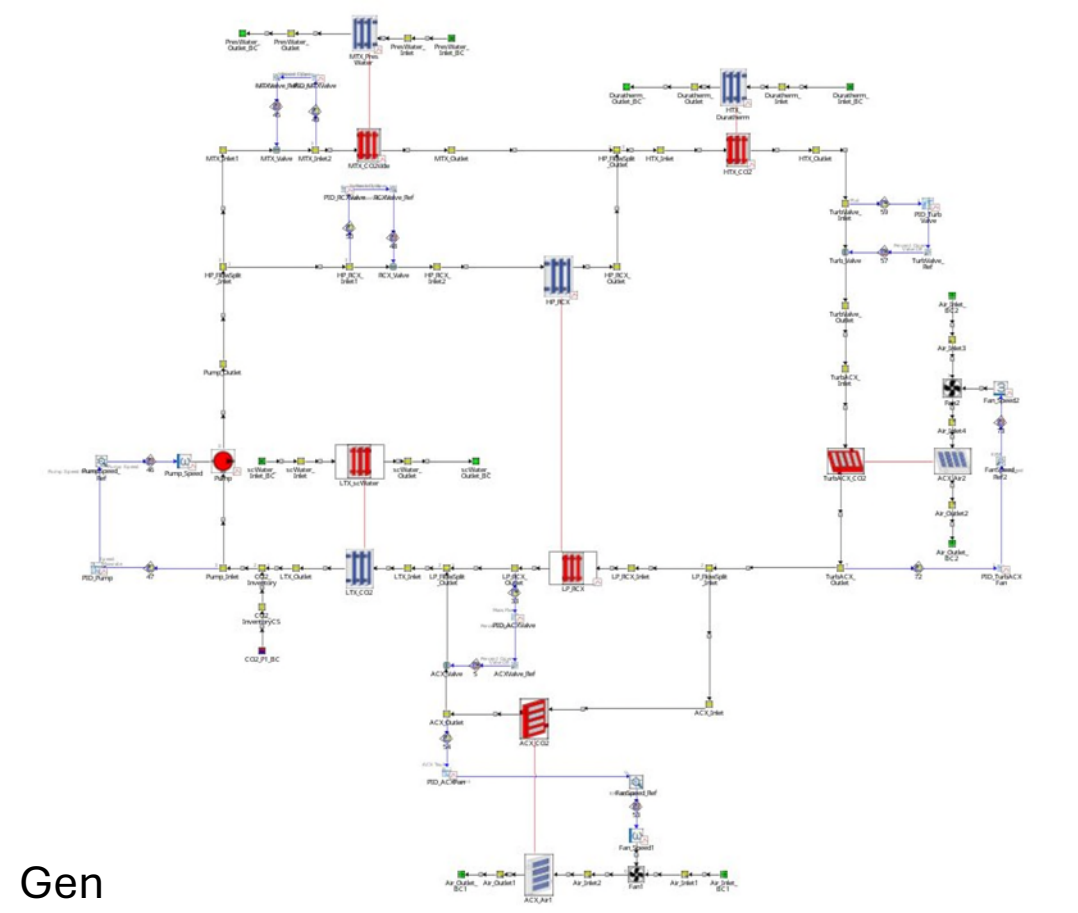


Other ongoing activities

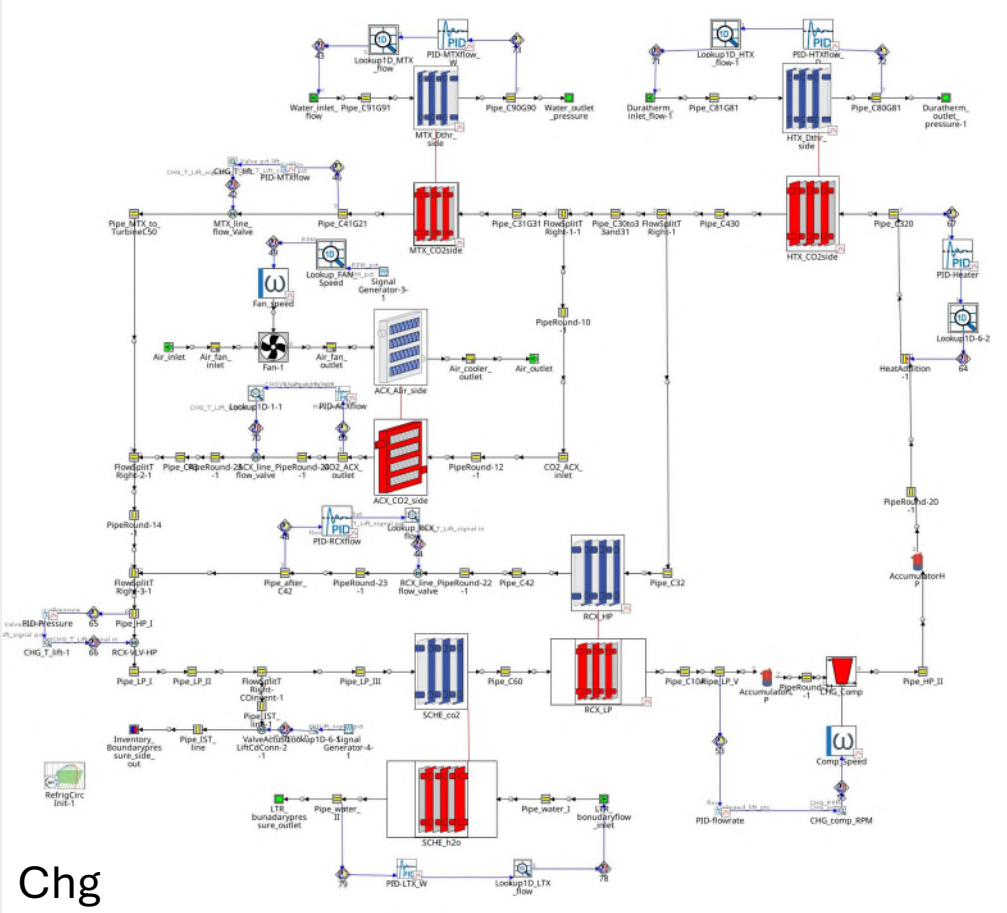
- Operation and controls simulation – reservoir state management
- Turndown and thermal loss modeling



Full system transient model / controls optimization



Gen



Chg

sCO₂ Power Cycle in Practice

EPS100

- 7.3 MWe net output
- Delivery to customer site early 4Q26
- Operational in 2027



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