U.S. DEPARTMENT OF ENERGY | Office of ENERGY EFFICIENCY & RENEWABLE ENERGY

SOLAR ENERGY TECHNOLOGIES OFFICE

SETO CSP Program Summit 2019

Advanced Supercritical Carbon Dioxide Cycles: Switched-bed Regenerators

Advanced Projects Offering Low LCOE Opportunities

APOLLO

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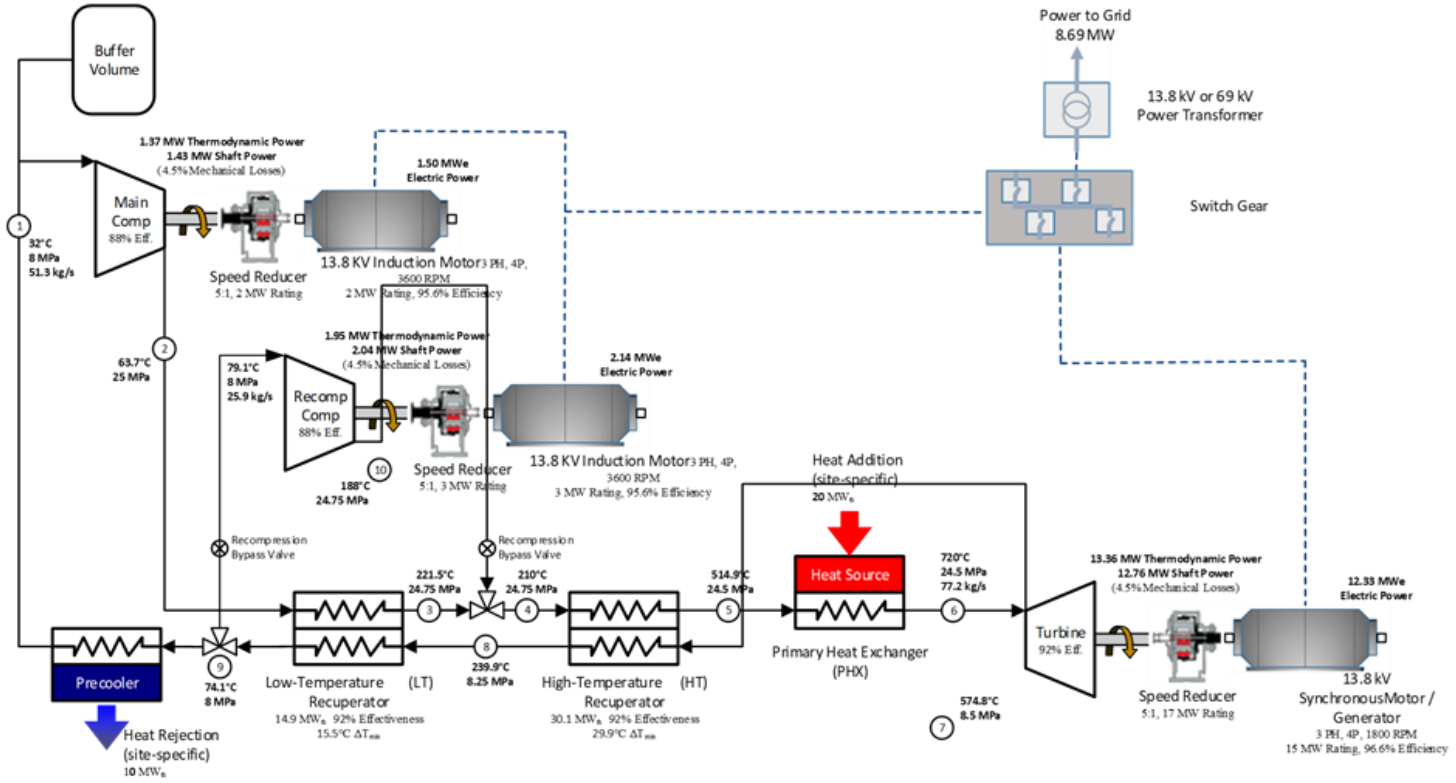
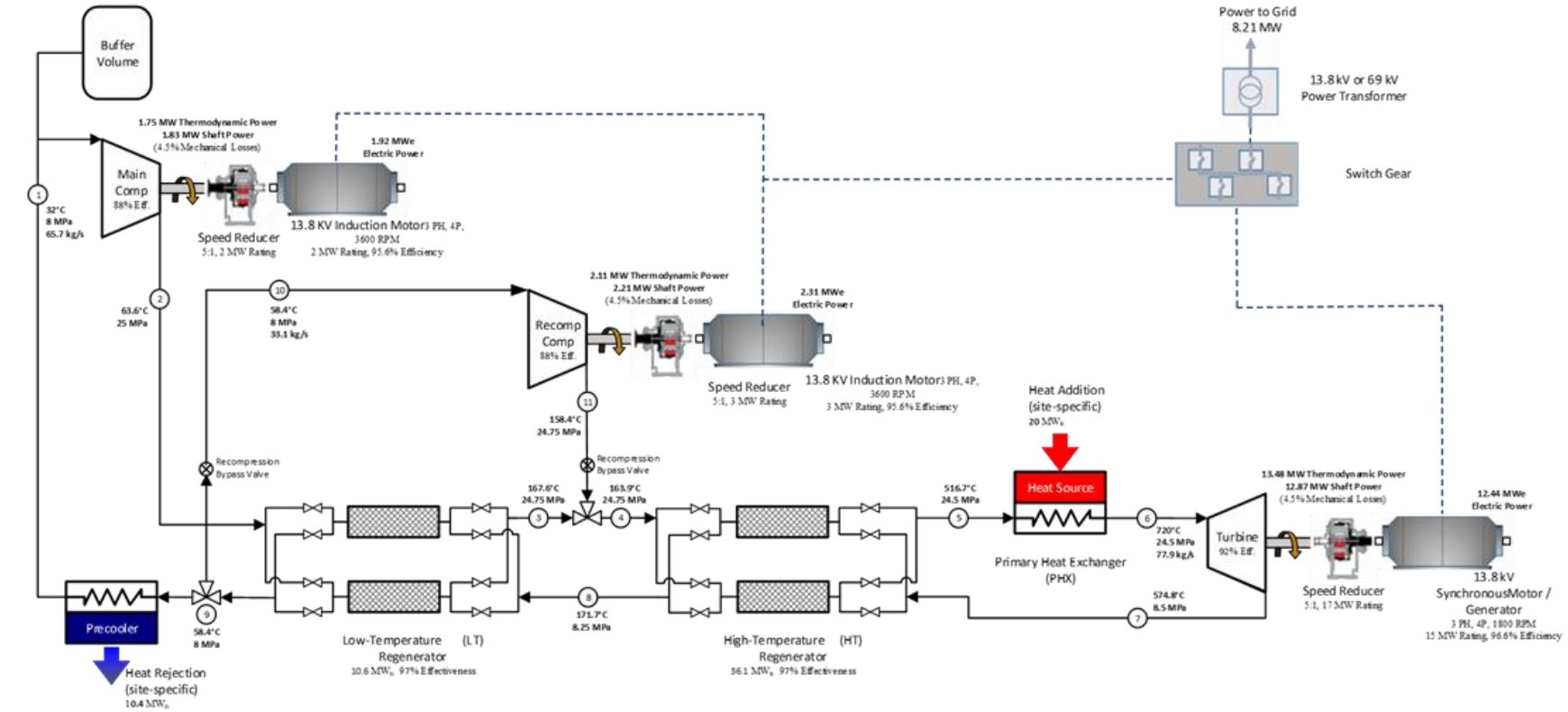
Key Technical Challenge: High Recuperation Cost



Solution: Use Switched-bed Regenerators Instead



Switched-bed Regenerators

1. Hot-to-cold blow

   Hot fluid flows through and transfers heat to the bed (bed heated, fluid cooled)

2. Pressurization

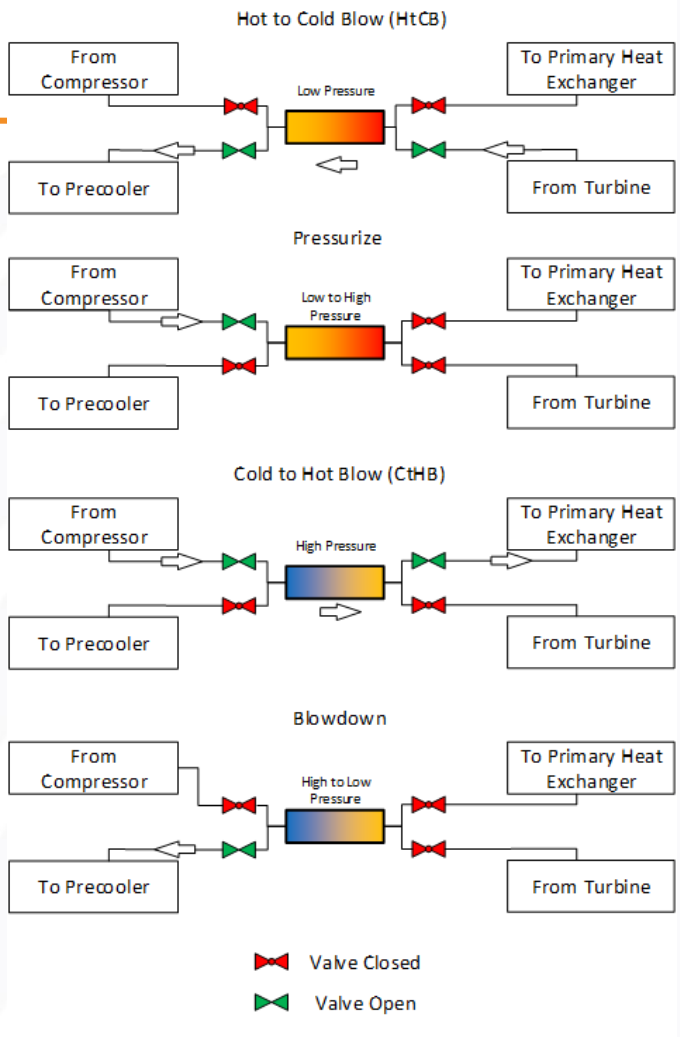
   Cold fluid pressurizes the regenerator

3. Cold-to-hot blow

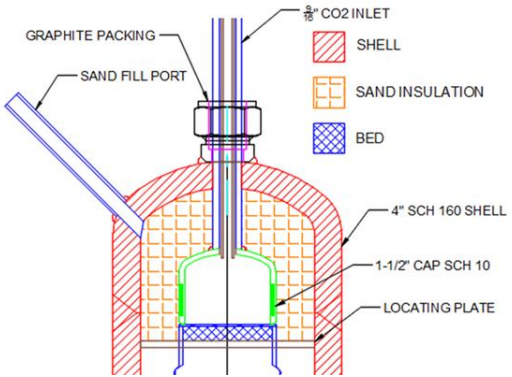
   Cold fluid flows through and receives heat from the bed (bed cooled, fluid heated)

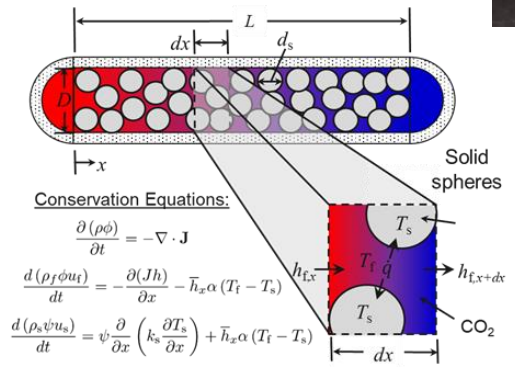
4. Blowdown

   High pressure fluid exhausts from the bed



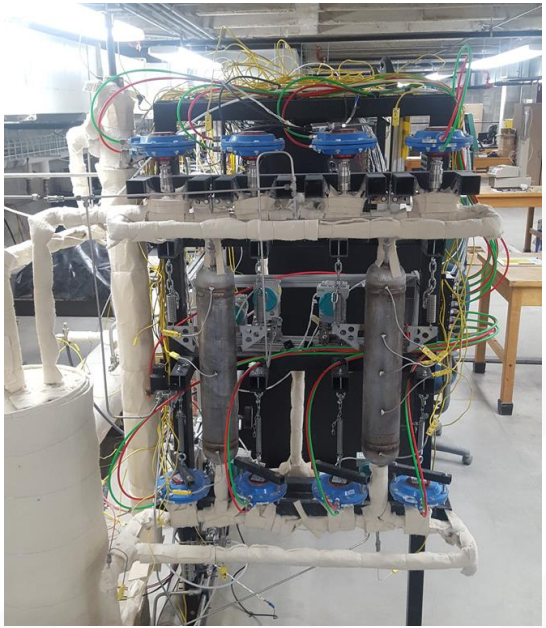
Internally-Insulated Regenerator Bed Construction



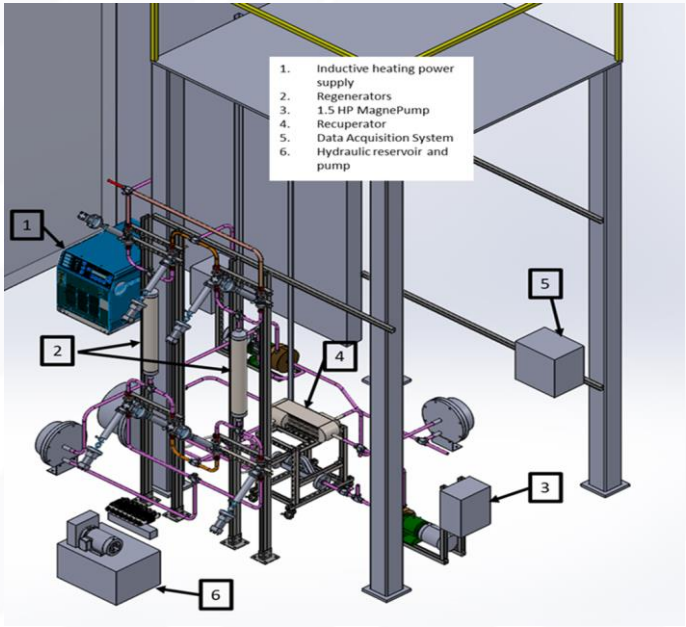


Model Validation Tests at Multiple Scales

5 kW_{th} UW-Madison Test

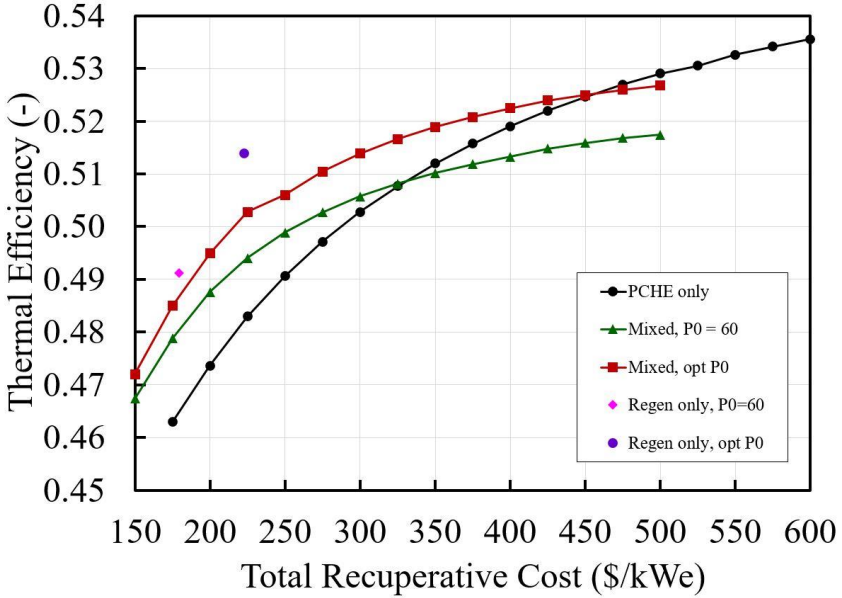


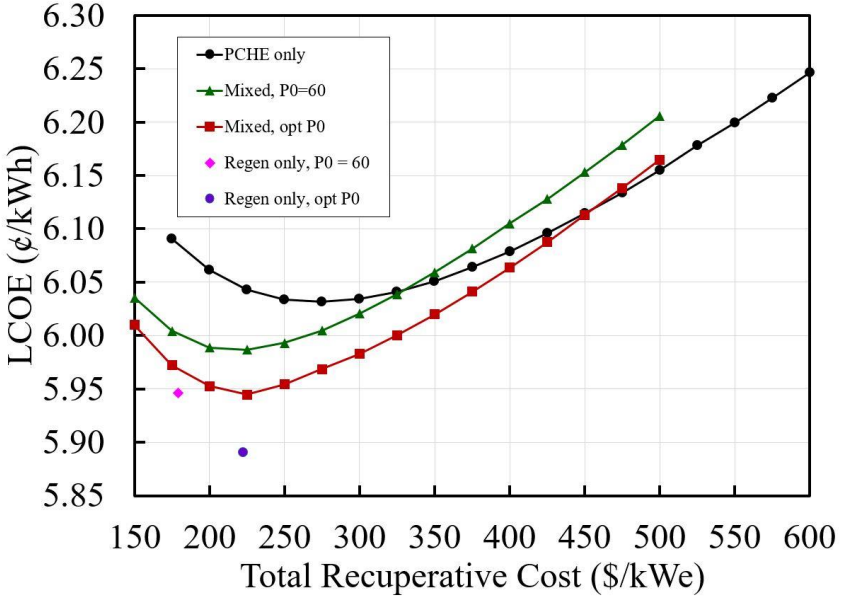
50 kW_{th} Sandia Test



Impact: Improved Efficiencies and Lower Cycle LCOE

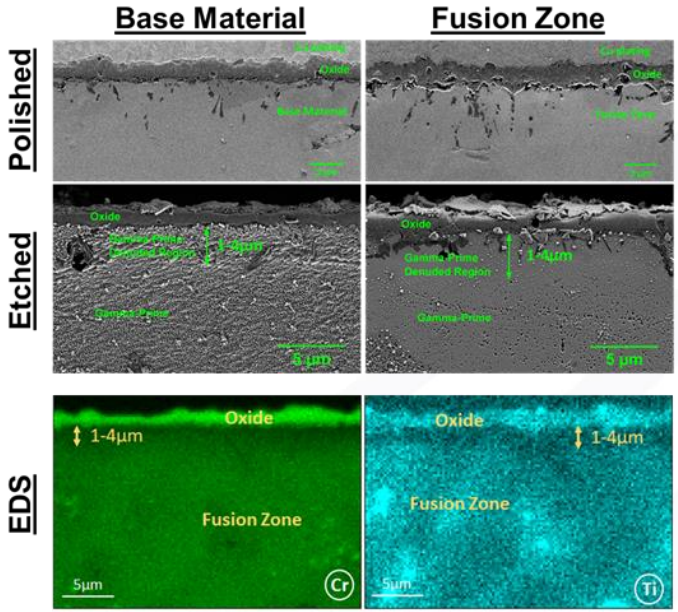
Best potential for replacing the high-temperature recuperator





Additional Impacts: Weld and Valve Development

740H and multi-material welds



High-cycle life valve seats