Development and Creation of a supercritical CO_2 (sCO_2) Energy Generation System

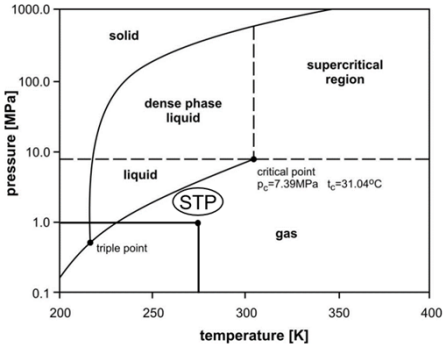
Raj Patel, M.S., GRA (University of Texas at San Antonio)
Diego Bass, M.S., GRA (University of Texas at San Antonio)
Christopher S. Combs, Ph.D., Asst. Prof. (University of Texas at San Antonio)

Supercritical CO_2 Power Cycles Symposium

UTSA Engineering

INTRODUCTION

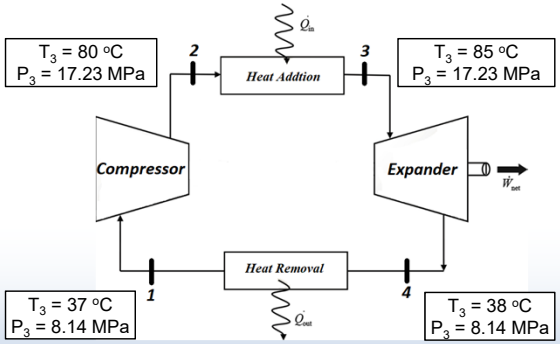
The use of sCO_2 for powerplants as working fluid can increase the cycle efficiencies significantly compared to steam. CO_2 can reach its supercritical state at near ambient temperature, effectively capturing energy from various heat sources.



sCO_2 Phase Diagram (Witkowski et al., 2014)

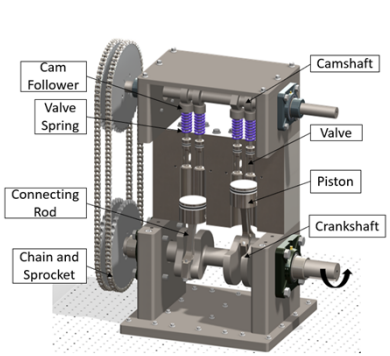
OBJECTIVE

This research aims to design and test a piston-driven expander to generate power at kilowatt-scale using sCO_2 as a working fluid in a closed-loop Brayton cycle for the ultra-low temperature heat sources.

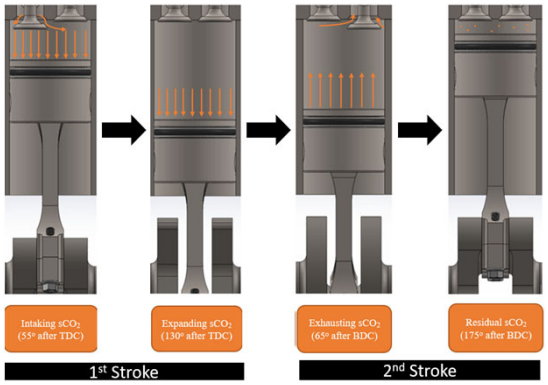


Closed Loop sCO_2 Brayton Cycle Schematic

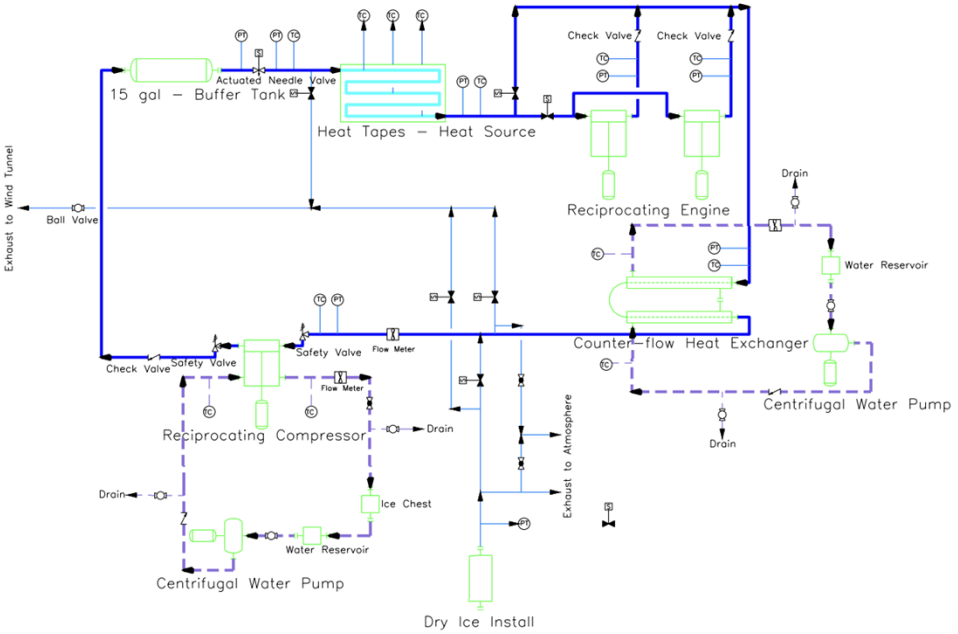
DESIGN AND OPERATION



Twin Cylinder sCO_2 Piston Engine

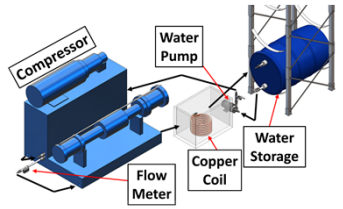


Sequence of Events Per Cycle

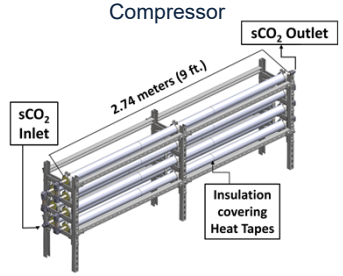


Loop P&ID Schematic

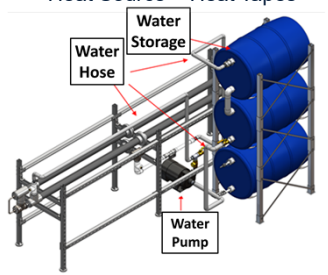
AUXILIARY COMPONENTS



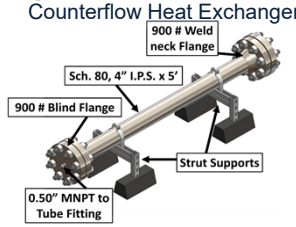
Compressor



Heat Source – Heat Tapes



Counterflow Heat Exchanger



Dry Ice Install – Pressure Vessel

ACKNOWLEDGEMENTS

This project and the preparation of this report were funded in part by monies provided by CPS Energy through an agreement with The University of Texas at San Antonio. Copyright 2021 CPS Energy and the University of Texas at San Antonio.