Carleton UNIVERSITY

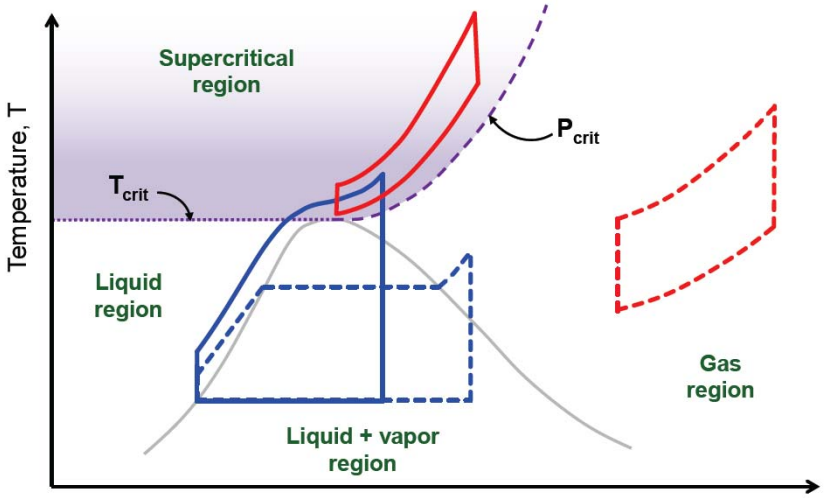
Carleton University Brayton Cycle Loop (CUBCL) Design

Mechanical and Aerospace Engineering

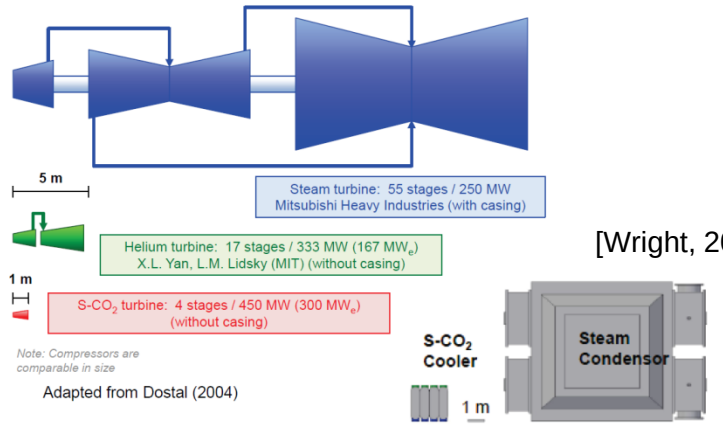
4th Year Project – 2017/18

S-CO_2 Power Cycles

- Supercritical working fluids
  - P, T > critical values
  - Properties change dramatically near critical point
- High density near critical point
  - Reduced compressor work, compact turbomachinery
- Good efficiency potential
- Near-ambient critical temperature
  - Availability of sinks/sources



[Wilkes, 2013]



[Wright, 2011]

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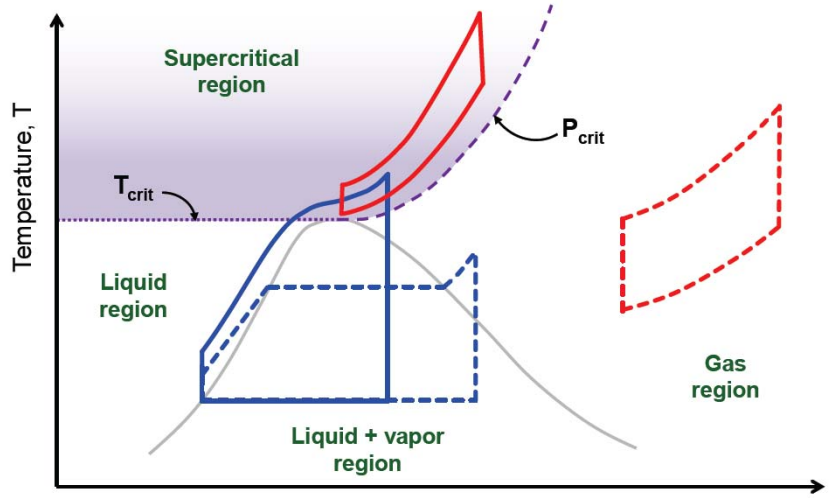

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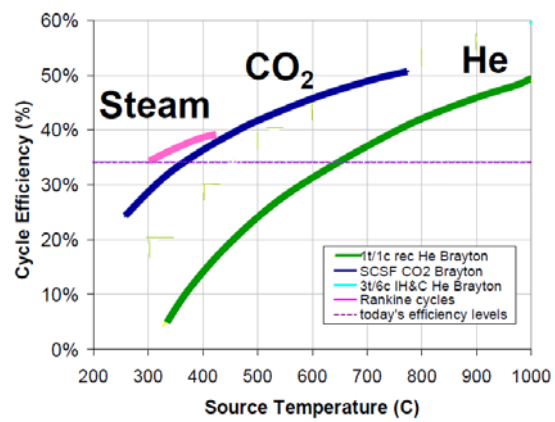


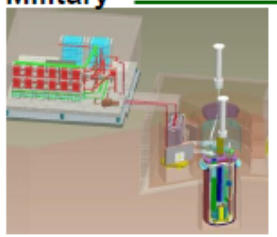
[Wright, 2011]

S-CO_2 Power Cycles

Solar

SNL Solar Tower

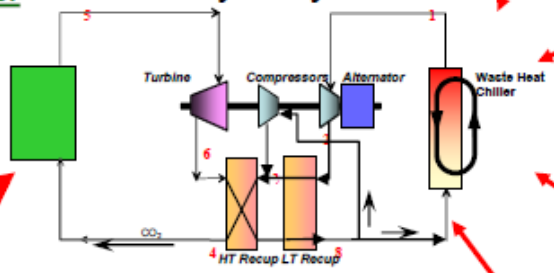
Military Fix Base & Marine



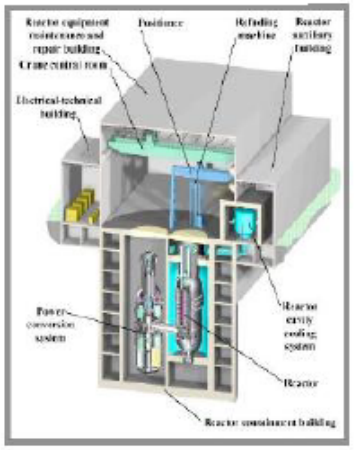
ARRA Geothermal

Waste Heat Bottoming Cycle to a Gas Turbine

Supercritical CO_2 Brayton Cycle

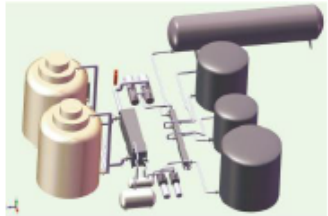


Nuclear (Gas, Sodium, Water)



DOE-NE Gen IV

Carbon Capture & Sequestration
CCS+EOR
Fossil Oxy-Combustion



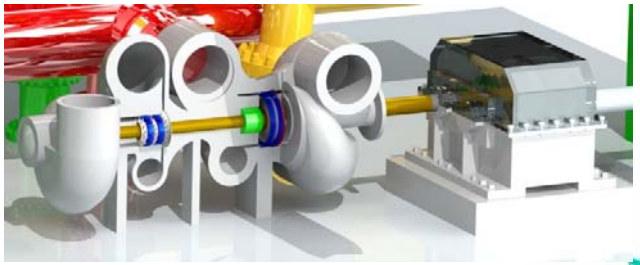
Energy Storage & Heat Transport & CCHE

SNL has Funding or Research Agreements with most Agencies Representing these Heat Sources

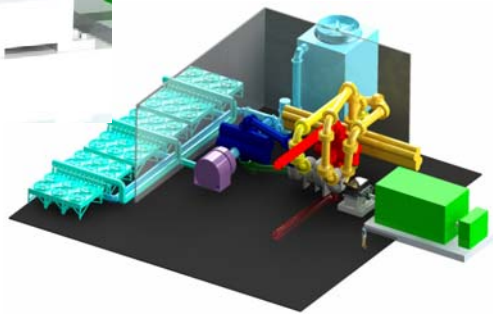
[Wright, 2011]

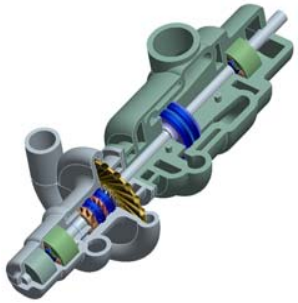
Project History

- 2006-11: 100 MW_e plant
- 2001-12: 10 MW_e plant
- 2012-16: 250 kW_{th} pilot-scale, 10 MW_e plant
- 2016-17: hiatus

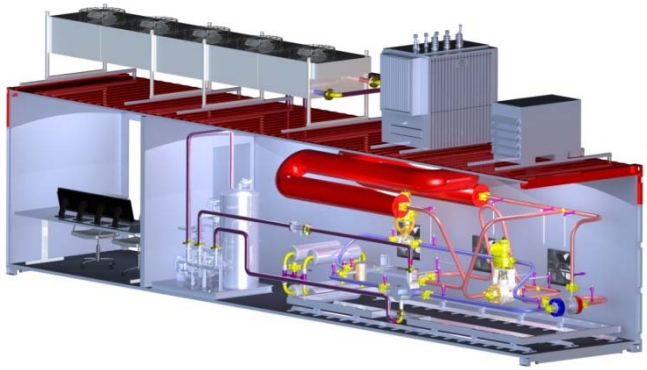


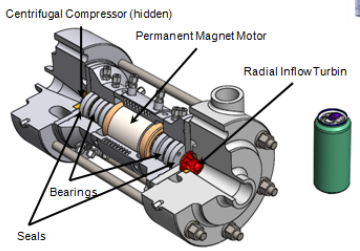
100 MW_e plant
(2006-11)





10 MW_e turbomachinery
(2011-12)





250 kW_{th} pilot-scale Brayton cycle loop
(2012-16)

2017-18 Project

- 250 kW_{th} pilot-scale facility
  - Continue work
    - Finish design work (e.g. piping, electrical, turbomachinery integration)
    - Facility installation
    - Commissioning, testing (future)
    - Dynamic modelling and simulation
    - Model validation (future)
- 10 MW_e US DOE project support
  - Preliminary thermodynamic, aerodynamic, structural/mechanical design
  - Modify dynamic model for 10 MW_e facility
  - https://energy.gov/under-secretary-science-and-energy/articles/doe-announces-80-million-investment-build-supercritical
  - http://www.gastechnology.org/news/Pages/GTI-Selected-to-Lead-a-Supercritical-CO2-Project.aspx

Questions?

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