

*the Energy to Lead*

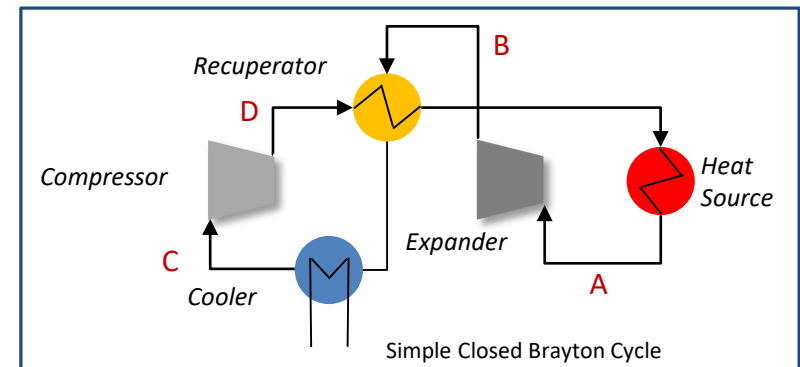
# Supercritical CO<sub>2</sub> Pilot Plant Test Facility Project

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**Technology Manager**  
**Gas Technology Institute**  
**UTSR Meeting - 1 Nov 2017**

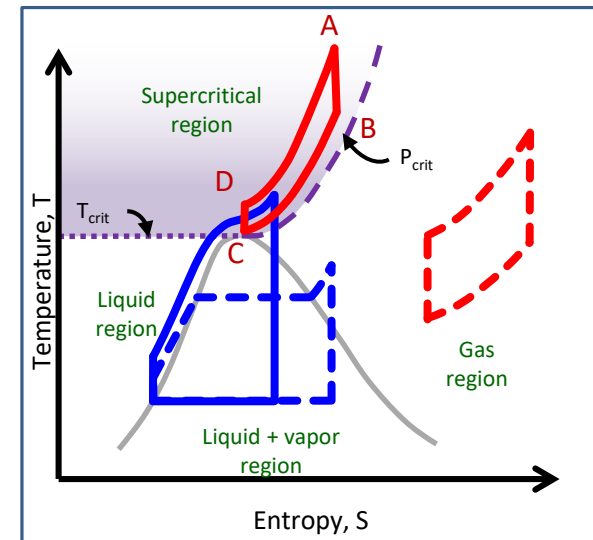
# Introduction: sCO<sub>2</sub> Power Cycles

- Heat-to-power conversion cycles with supercritical CO<sub>2</sub> working fluid
- Unique thermodynamic properties offer several advantages

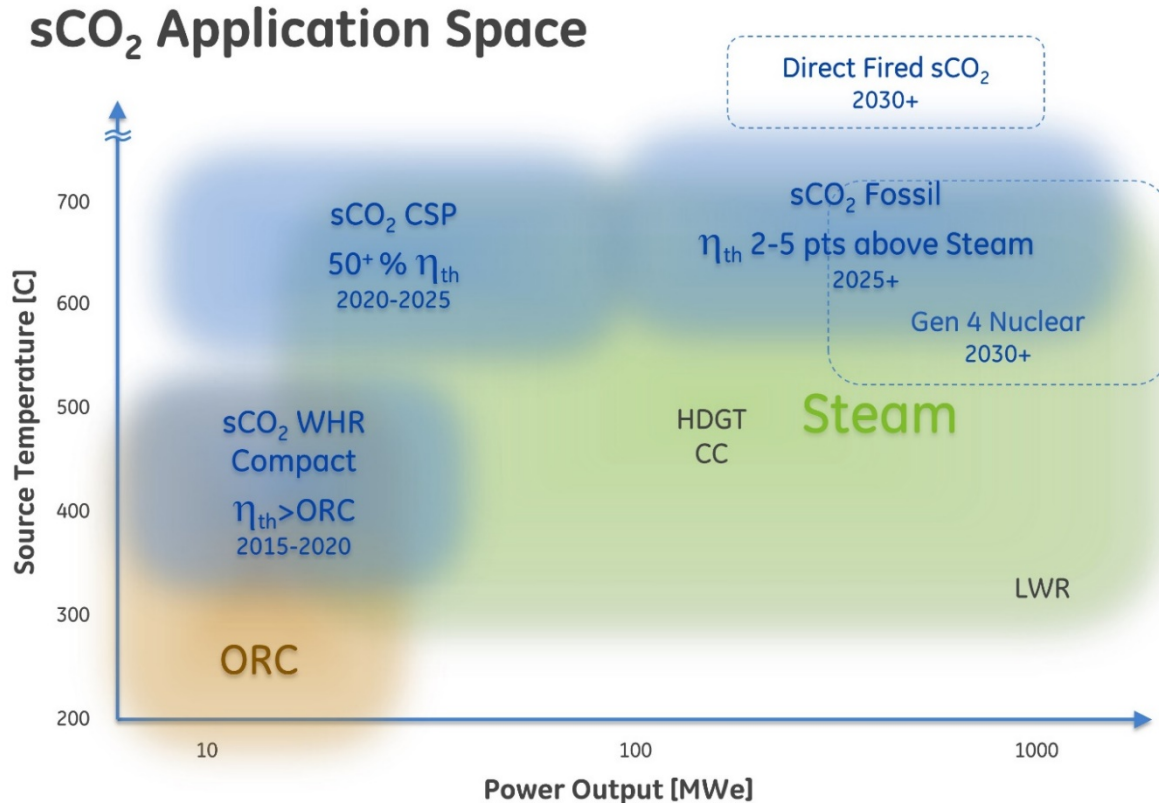


## ➤ sCO<sub>2</sub> Cycle Benefits:

- Higher efficiencies
- Compact turbo-machinery
- Lower water consumption
- Heat source agnostic
- Potential to lower COE



# Versatile Technology with Multiple Applications



Development of Supercritical CO<sub>2</sub> Power Cycle Applications – The Pathway Forward  
 IGTI Turbo Expo | Dusseldorf, Germany | 19 June 2014

# STEP Project Synopsis

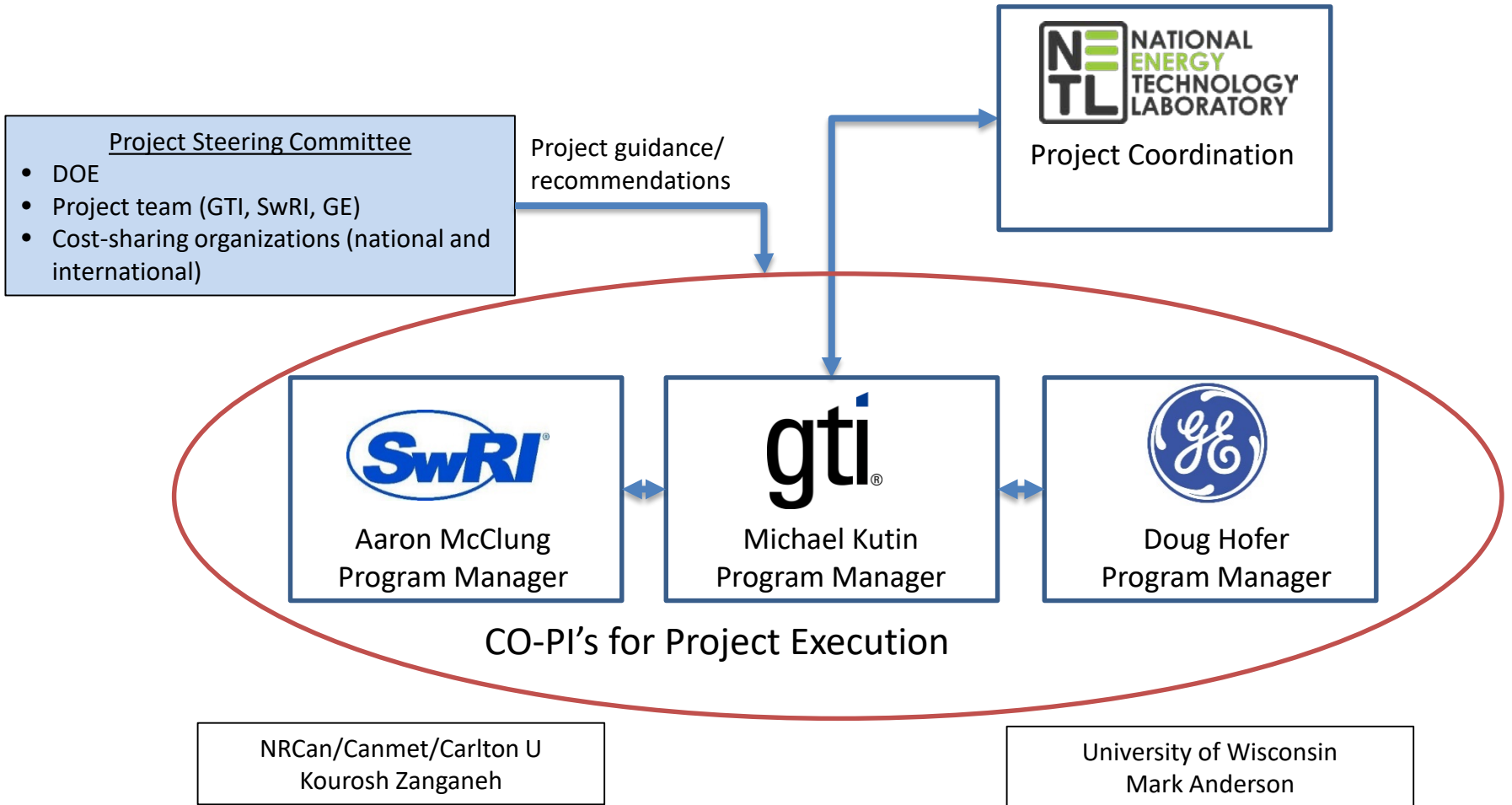
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- **S**upercritical **T**ransformational **E**lectric **P**ower project
- Goal - design, construct, commission, and operate a 10 MW<sub>e</sub> sCO<sub>2</sub> Pilot Plant Test Facility
- Facility will be versatile and reconfigurable
- The team is led by Gas Technology Institute (GTI), Southwest Research Institute (SwRI) and General Electric Global Research (GE-GR)
- The Pilot Plant Test Facility will advance the state of the art for high temperature sCO<sub>2</sub> power cycle performance from Proof of Concept (TRL 3) to System Prototype Validated in an Operational System (TRL 7)

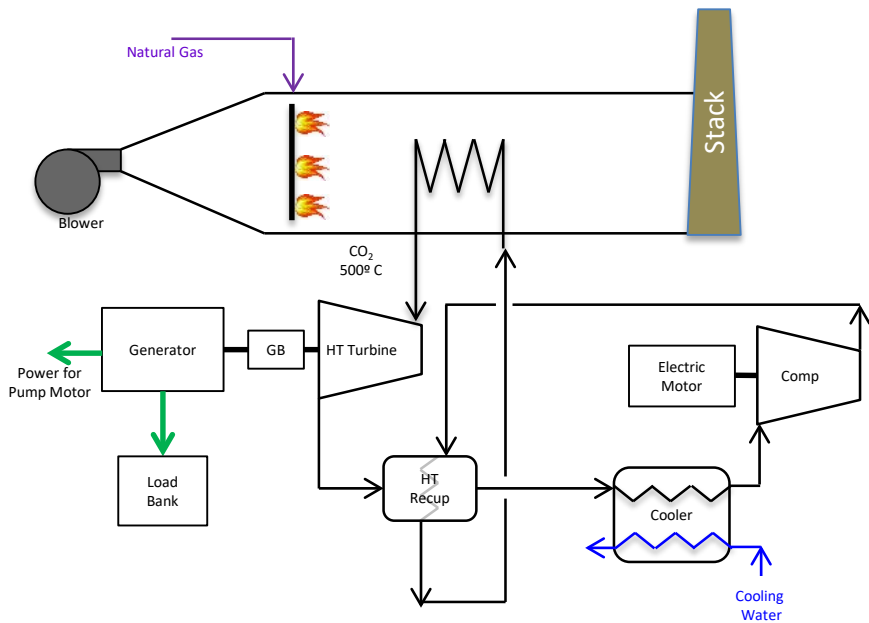
# Project Objectives

- Demonstrate the operability of the sCO<sub>2</sub> power cycle
- Verify the performance of components (turbomachinery, recuperators, and compressors, etc.)
- Show the potential for producing a lower cost of electricity and the potential for a thermodynamic cycle efficiency greater than 50%.
- Demonstrate at least a 700°C turbine inlet temperature and a recompression closed Brayton cycle (RCBC) configuration that demonstrates system and component design and performance, including generating at least 10 MW<sub>e</sub>
- Reconfigurable facility to accommodate future testing
  - System/cycle upgrades
  - New cycle configurations (i.e., cascade cycles, directly fired cycles, etc.)
  - New or upgraded components (turbomachinery, recuperators and heat exchangers)

# Project Execution Organization

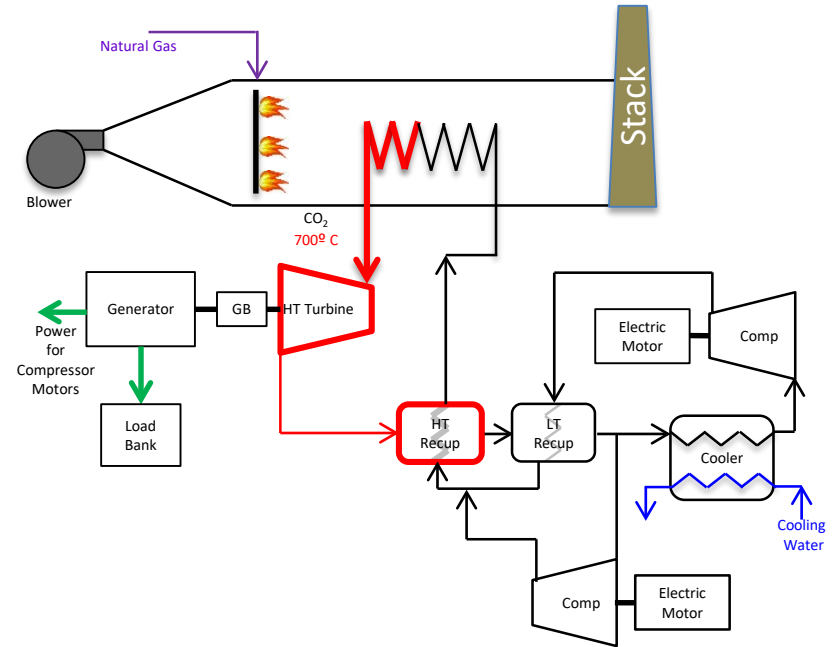


# Flexible 10 MW<sub>e</sub> Facility with Phased Testing Approach



## Simple Cycle

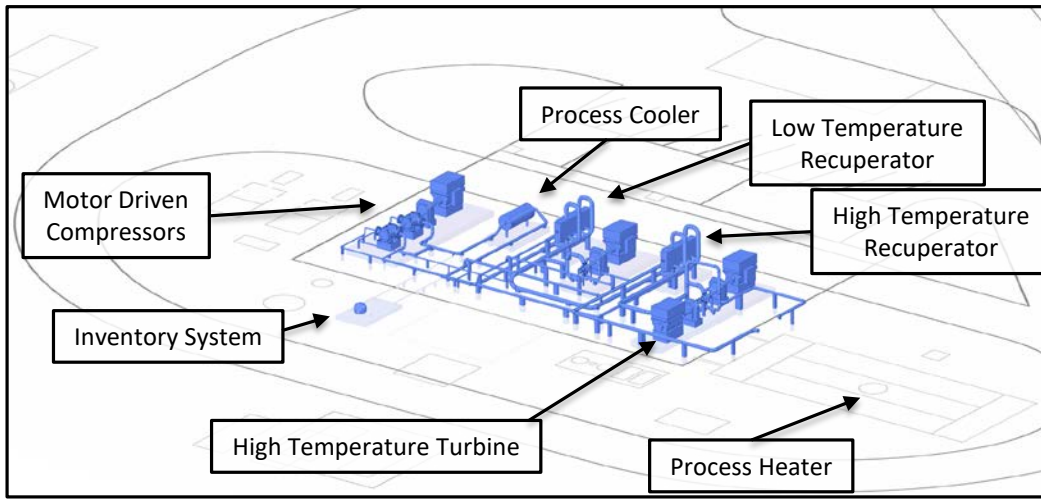
- Shortest time to initial data
- Controls & Safety
- Component performance
- Steady & Transient cycle data



## Recompression Cycle

- Inventory management
- Starting transients
- Parallel compressor control
- SOA component efficiencies
- Cycle efficiency > 50%

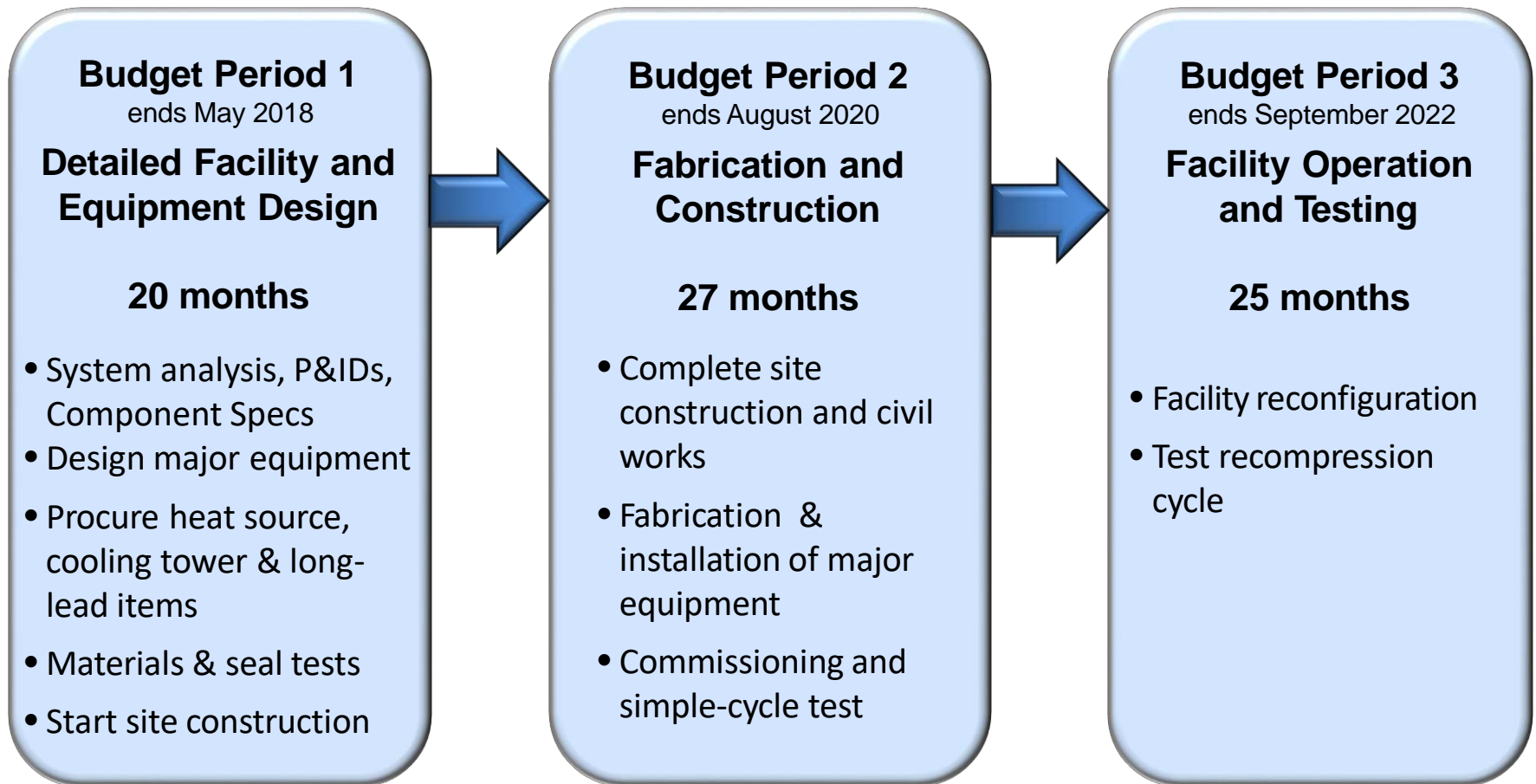
# Pilot Plant Test Facility Greenfield Site on SwRI Campus





# Supercritical CO<sub>2</sub> Pilot Plant Test Facility

## 6 Year Program Plan



# Current Project Status

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- Design criteria document draft completed
- PFDs completed & frozen
  - Operational & casualty scenarios under review
  - System steady state models developed
  - Dynamic modeling initiated
  - P&IDs in work
- Major equipment procurements being worked
  - Heat source vendors under contract - fabrication to start in December
  - Compressor RFP updated, going to GE-Baker Hughes
  - Updating recuperator and cooling system RFPs
  - Turbine stop valve design in work - seal tests to start in December
- Plant, equipment & piping layout studies in process
- Materials test planning ongoing



# OSTEP

A U.S. DEPARTMENT OF ENERGY PROJECT

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GTI • SwRI • GE Global