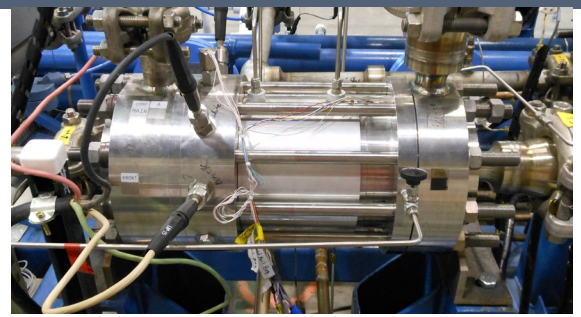
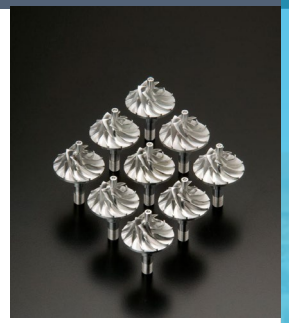
Office of Nuclear Energy - Advanced Reactor Technologies (ART)

Presented by :

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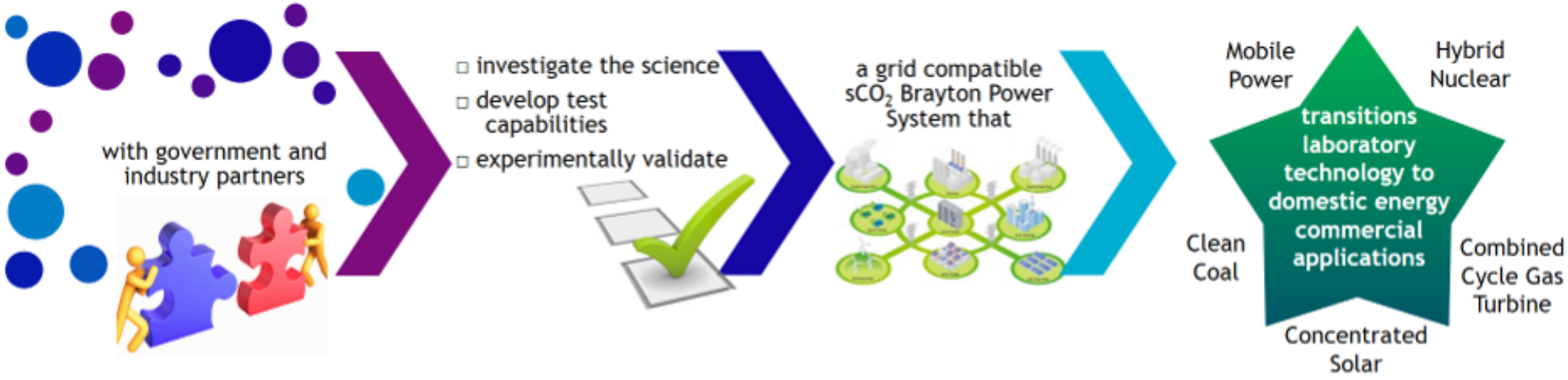
Supercritical Transformational Electric Power (STEP) Program

U.S. DEPARTMENT of ENERGY

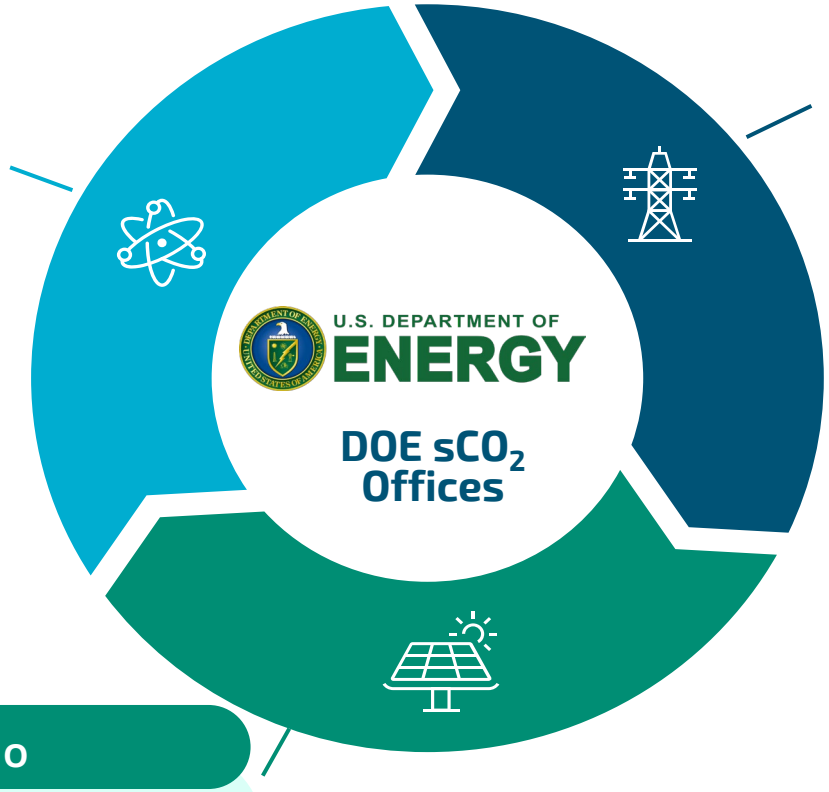
Program Goal and Objectives

DOE-NE Office of Advanced Reactor Technologies , in collaboration with government and industry partners, shall investigate the science, develop the test capabilities, and experimentally validate a grid compatible sCO_2 Brayton Power System that transitions laboratory technologies to domestic energy commercial applications.



1. To support coordination and collaboration across labs and with industry
2. To lead R&D that ensures systematic identification and retirement of risks to ensure component readiness
3. To lead R&D that is inclusive of elements that increase the reliability and resiliency of electric power systems
4. To establish the foundations for successful commercialization of the technology

The "STEP Tech Team" Crosscut



DOE NE

Primary Driver: Lead, Sodium, Helium, Molten Salt Reactors, Small Modular Reactors

Applications of Interest:
- Nuclear
- Distributed Energy
- Shipboard Power

Size: 50 – 100 MWe
Temperature: 700°C
Configuration: RCBC with Dry Heat Injection

DOE FE

Primary Driver: Overall efficiency greater than 50%

Applications of Interest:
- Fossil fuel primary cycle
- Direct sCO_2 cycles
- Waste heat recovery
- Distributed energy sources

Size: 600 MWe
Temperature: 700 - 760°C
Configuration:
- RCBC with IC
- RCBC with IC with re-heat
- RCBC with economizers
- Partial cooling cycles

DOE SETO

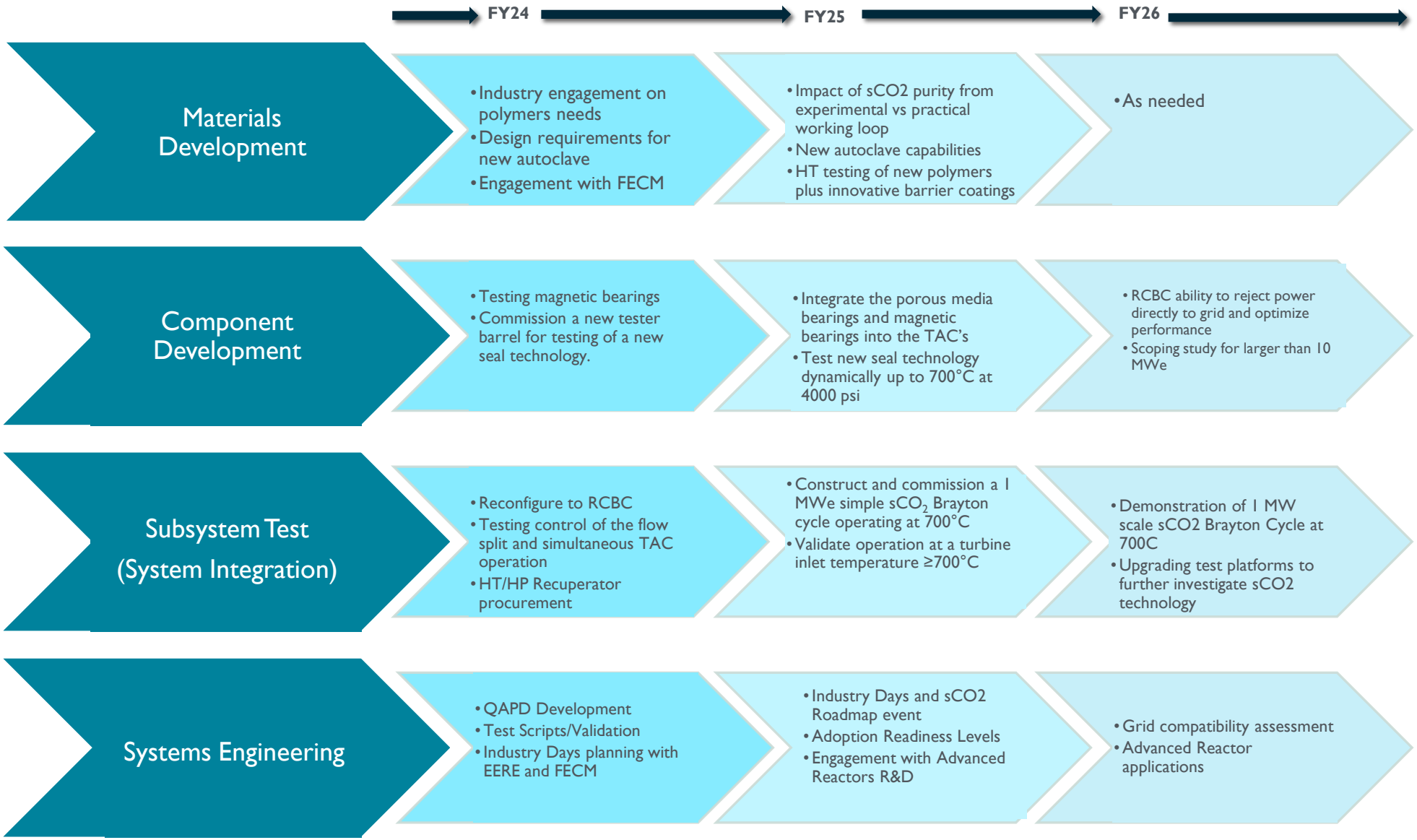
Primary Driver: LCOE <$0.06/kWhe-hr

Applications of Interest:
- Concentrated Solar Power
- Waste Heat Recovery

Size: 10 – 100 MWe
Temperature: 650 - 700°C
Configuration:
- RCBC partial cooling cycle
- Isothermal compression based simple cycles
- Coupling with thermal energy

The Supercritical Transformational Electric Power (STEP) mission is to **reduce the technical barriers and risks to the commercialization of the sCO_2 power cycle.** The program aims to work with industry to develop and mature the technology at the pilot scale in order to facilitate commercialization.

Major Activities and Expected Outcomes (FY24 – FY26)



What the end of FY26-27 look like:

- Demonstration of technology needed for commercialization of a sCO_2 Brayton power conversion cycle, ready for grid optimization
- CBC cycle demonstration at high temperature & pressure
- Reduced risk to industry (higher TRL & value positioned in industry terms)

Challenges

- Funding uncertainty limits ability to place purchases on the proposed timeline
- Supply chain delays

STEP RFI 2026

- Promote Industry collaboration
- Elevate TRL level of critical components
- Path forward to sCO2 commercialization

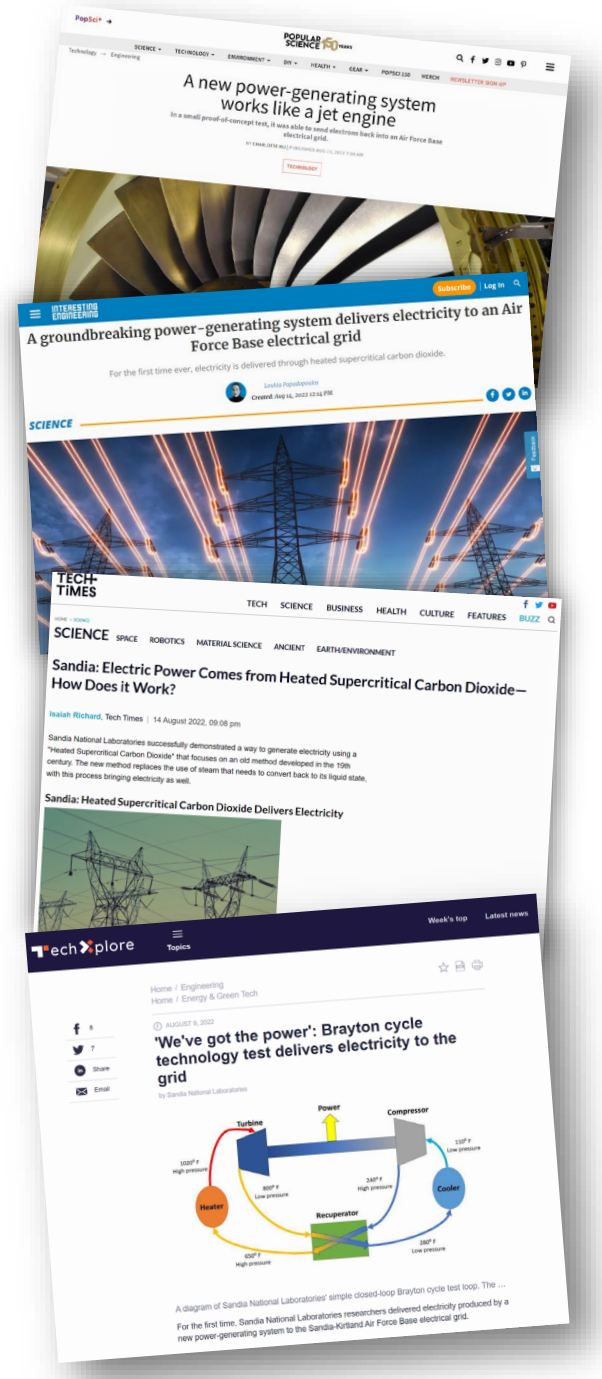
https://sam.gov/opp/143b8ad8001c483eb0ec9d3123a314f3/view

Past/Current areas of research include:

- Turbomachinery
- Heat Exchangers
- Bearings
- Seals
- Component Fatigue
- Economic Modeling

Keys to Success

- **Collaboration** with industry partners
- Conference proceedings and journal articles cement **Sandia's reputation as a leader in Brayton testing capabilities**.
- **Technical advances** and patent applications/awards
- Flexibility to couple fossil, nuclear, and renewable energy sources to advance power conversion systems – **unique to Sandia** and not done anywhere else in the world
- **Flexibility** to serve land and space-based power conversion cycles
- **Excellent project management**. Meeting project milestones, deliverables, and budgets.



Questions?

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