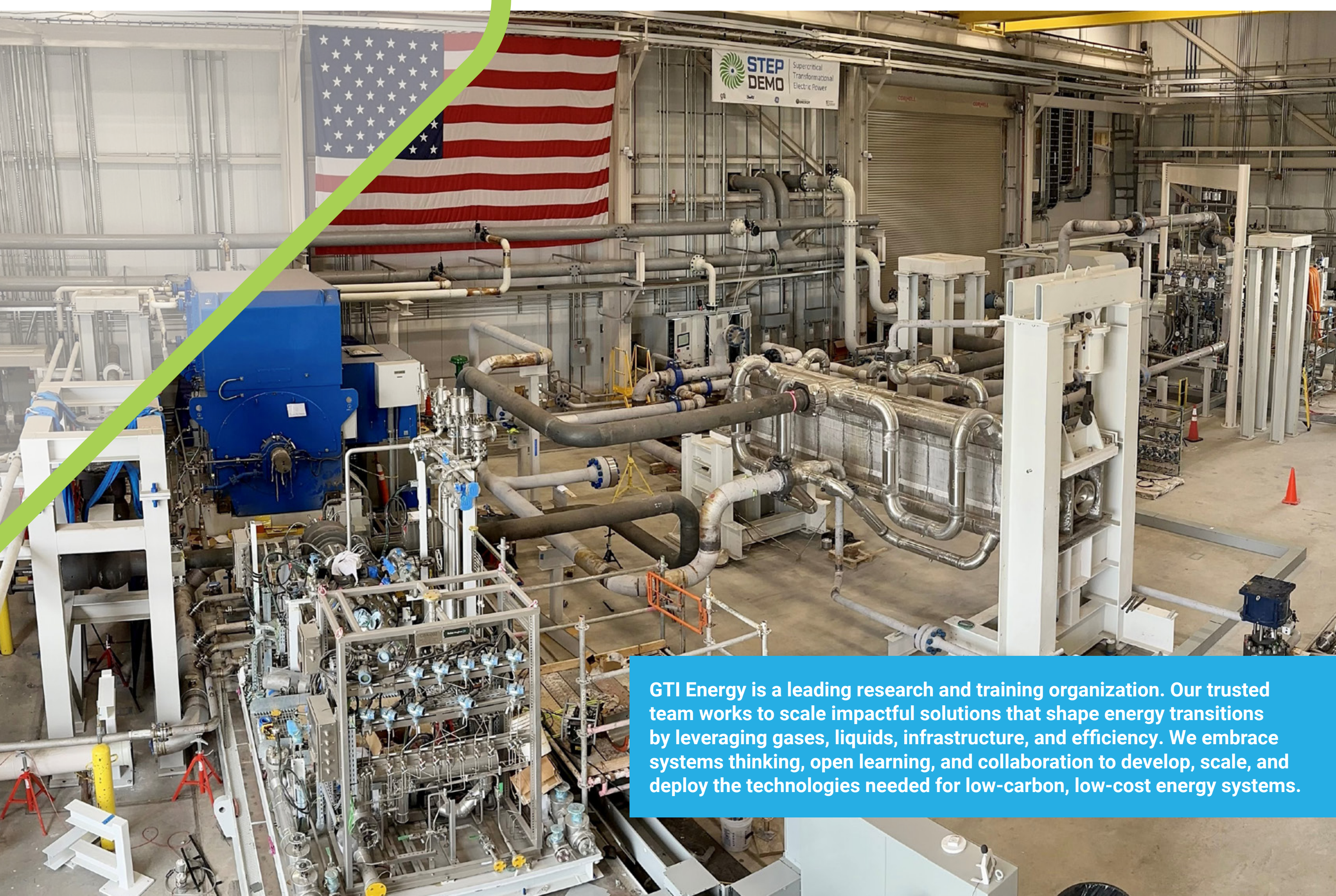
www.gti.energy

GTI ENERGY

solutions that transform

SUPERCRITICAL CO_2 TECHNOLOGIES



GTI Energy is a leading research and training organization. Our trusted team works to scale impactful solutions that shape energy transitions by leveraging gases, liquids, infrastructure, and efficiency. We embrace systems thinking, open learning, and collaboration to develop, scale, and deploy the technologies needed for low-carbon, low-cost energy systems.

SUPERCRITICAL CO_2 TECHNOLOGIES

Advancing high-efficiency supercritical carbon dioxide Brayton cycle systems for power generation

Supercritical carbon dioxide (sCO_2) is traditionally associated with carbon capture and storage technologies. In this power production application, however, sCO_2 is used as the working fluid instead of steam to run a turbine in a Brayton cycle, providing lower-cost electricity generation. The CO_2 is maintained above the critical point so that it remains in liquid phase, allowing a large amount of energy to be extracted at high temperature which in turn leads to greater energy efficiency from a dramatically smaller turbine. Thus, the thermodynamic advantages of supercritical CO_2 as a working fluid allows a power plant to generate the same amount of electricity from less fuel with smaller equipment, which decreases CO_2 emissions and operating costs.

GTI Energy was awarded a $125 million contract by the U.S. Department of Energy's (DOE's) Office of Fossil Energy to design, build, and operate a sCO_2 Brayton Cycle test facility at a scale of 10 megawatts of electrical power generation. GTI Energy is teamed with GE Global Research and Southwest Research Institute (SwRI) on this project under the DOE's Supercritical Transformational Electric Power (STEP) program. The facility is located at SwRI's campus in San Antonio, TX. Construction was started in 2019 and commissioning started in 2022. This public-private STEP test facility will provide an independent, integrated sCO_2 platform to qualify, de-risk and mature materials, components, technologies, and power cycles with rigor and transparency to support the adoption of this technology by the power industry.

A Joint Industry Program (JIP) has been formed to provide a mechanism for industry partners to benefit from STEP Demo. JIP members can provide guidance to the operation, have access to project data, and have preferential rights to project IP.

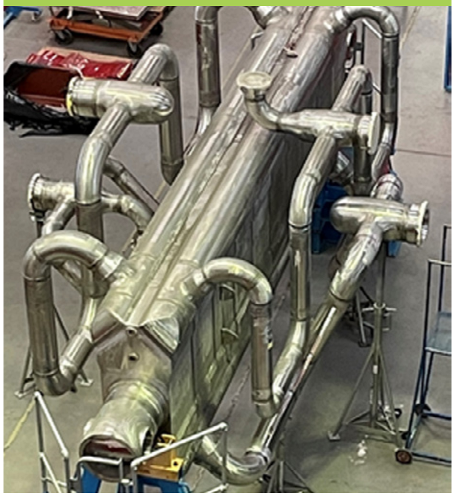
STEP Demo is an open project, and we welcome discussions with all parties to join through the JIP.

Up to date information on the status of STEP Demo can be found at www.stepdemo.us.

Previous work with sCO_2 technologies to advance efficiency and emissions improvements in power generation began with a project to validate proposed turbomachinery concepts through engineering and thermodynamic analyses, test materials for these unique environments, and develop a plan to close technology gaps. Project results enable indirectly-heated cycles to achieve thermodynamic cycle efficiencies of 50–52%, and enable directly-heated cycles to achieve efficiencies equal to or greater than 52% with flue gas CO_2 capture. GTI Energy led projects for the DOE Office of Fossil Energy Advanced Turbines program and the DOE Office of Nuclear Energy in collaboration with Duke Energy, GE, EPRI, and others.

85% reduction in turbomachinery size

Completed high temperature recuperator (HTR)



Key Features

- Highly compact turbomachinery
- Large temperature range
- High thermodynamic efficiencies at >550°C
- Stable, non-toxic working fluid

Applications

- Waste heat recovery
- Fossil (coal, natural gas)
- Solar-thermal
- Nuclear

Benefits

- 2–5% plant efficiency increase for same turbine inlet temperature
- 85% reduction in turbomachinery size
- Lowers emissions for fossil plants

Markus Lesemann
Senior Director, Business Development
mlesemann@gti.energy, +1 847.768.0914

GTI Energy
www.gti.energy
1700 S Mount Prospect Road
Des Plaines, IL 60018 USA

6-23