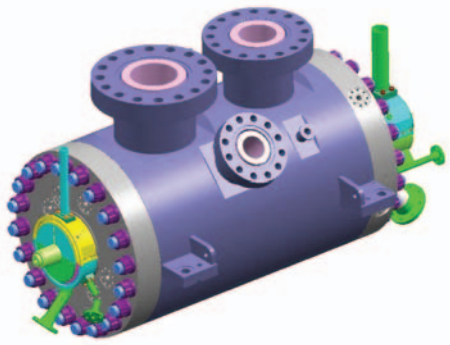
10-MW Supercritical-CO_2 Turbine

NATIONAL RENEWABLE ENERGY LABORATORY	NREL
PROGRAM:	SunShot CSP R&D 2012
TOPIC:	Advanced Power Cycles
LOCATION:	Golden, Colorado
AWARD AMOUNT:	Up to $8 million
PROJECT TERM:	2012–2015



This project's team will build a prototype of the largest and highest-temperature s-CO_2 closed Brayton power cycle turbine ever constructed. The use of carbon dioxide instead of steam allows higher power-cycle efficiency and more compact cycle components. *Illustration from Dresser-Rand*

CONTACTS

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Partnering Organizations:
- Sandia National Laboratories
- University of Wisconsin
- Echogen Power Systems, LLC
- Abengoa Solar
- Electric Power Research Institute
- Barber-Nichols Incorporated

MOTIVATION

Current state-of-the-art, molten-salt power towers have an operating limit of approximately 565°C. When combined with a dry-cooled steam Rankine power cycle, these systems have a thermal-to-electric conversion efficiency of approximately 41%. Transitioning to higher-temperature power cycles can improve plant efficiency, reduce the required size of the solar field and thermal storage system, and decrease overall plant cost.

PROJECT DESCRIPTION

The research team intends to showcase the turbomachinery for a new cycle—the supercritical carbon dioxide (s-CO_2) Brayton cycle. To establish the true potential of this power cycle, the researchers are working to validate the operation of a large-scale prototype at temperatures and conditions relevant to concentrating solar power (CSP) systems.

IMPACT

Project members are building the largest and highest temperature s-CO_2 closed Brayton power cycle yet constructed. The cycle is being optimized and tested at conditions representing dry cooling in desert environments, thereby accurately simulating real-world CSP operating conditions. If successful, the research team will validate an s-CO_2 power turbine efficiency at a commercially viable level, and outline the pathway to high-efficiency power cycles that exceed 50% net thermal-to-electric conversion efficiency.

For more information, visit the project page at: www.solar.energy.gov/sunshot/csp_sunshotrnd_nrel_turbine.html.

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