Technoeconomic Study of Solarized s-CO_2 Power Cycles (CSP-1)

A joint India-U.S. research consortium funded under the *Joint Clean Energy Research & Development Center (JCERDC)*

Scientific Achievement:

Performed the first comprehensive technoeconomic analysis of alternative solar-driven supercritical CO_2 (s-CO_2) power cycles.

Significance and Impact:

Identified trade-offs in cost and performance among components in both concentrating solar power (CSP) and s-CO_2 power cycles to determine optimal configuration with lowest cost and greatest performance.

Research Details:

- Higher cycle efficiencies (nearly 50%) resulting from recuperation reduce required thermal input and costs of heliostat field and receiver.
- Lower ΔT across the primary heater (CSP source) resulting from recuperation increased required mass flow rate and costs of heat-transfer/storage media, but resulting cost increase was relatively small.
- Recuperated simple, recompression, and partial cooling s-CO_2 cycles yielded the lowest overall costs.

Publication: C. Ho, M. Carlson, P. Garg, and P. Kumar, "Cost and performance tradeoffs of alternative solar-driven supercritical CO_2 power cycles," *Proceedings of the ASME 2015 Power and Energy Conversion Conference*, San Diego, June 28–July 2, 2015.

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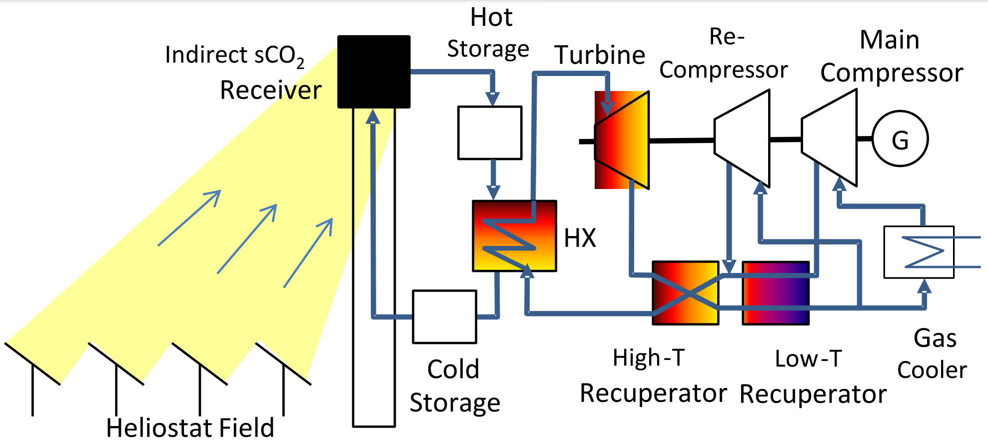

Solarized s-CO_2 recompression power cycle with thermal storage.

Table of solar and power block costs for alternative s-CO_2 power cycles.
SCBC = Simple Closed Brayton Cycle; RCBC = Recompression Closed Brayton Cycle; CCBC = Cascaded Closed Brayton Cycle; CBI = Combination Bifurcation with Intercooler

	SCBC	Recuperated SCBC	RCBC	CCBC	CBI
Concentrating Solar Costs ($/kWe)	7,210	2,840	2,930	4,170	2,730
Power Block Costs ($/kWe)	1,485	898	1,002	1,583	1,095
Total Costs ($/kWe)	**8,690**	**3,730**	**3,930**	**5,750**	**3,830**