One Inch Supercritical CO2 Micro Turbine Performance at 100 C, 300 C, 500 C, and 700 C

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https://infinityturbine.com/infinity-turbine-sco2-one-inch-micro-turbine-performance-at-100-300-500-700-c.html

Performance study of a one inch supercritical CO2 turbine. Estimated shaft power in kilowatts and heat rates in BTU per kilowatt are provided for four turbine inlet temperatures.

This webpage QR code

PDF Version of the webpage (maximum 10 pages)

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Overview

Supercritical CO2 (sCO2) micro turbines offer compact, high-density power at small scales. This article presents a sizing study of a purpose-designed one inch diameter sCO2 radial inflow turbine. Power output estimates are given at four turbine inlet temperatures, along with heat rates expressed in BTU per kilowatt.

Design Basis

Turbine outer diameter: 25.4 mm (1 inch)
Inlet annulus height: ~0.5 mm
Inlet pressure: ~150 bar
Turbine isentropic efficiency: ~70 percent
Whole cycle (turbine + recuperator + generator + compressor) derating: ~30 percent
Heat sink: ~40 C (104 F)

Estimated Shaft Power Output

Based on flow area, density, and enthalpy drops across typical stage pressure ratios, the one inch turbine could deliver:

100 C inlet: ~6 kilowatts net
300 C inlet: ~7 kilowatts net
500 C inlet: ~8 kilowatts net
700 C inlet: ~8.5 kilowatts net

Heat Rate in BTU per Kilowatt

Heat rate is the amount of heat input required per unit of power output. Conversion uses 1 kWh = 3412 BTU.

100 C source, 40 C sink
Practical efficiency ~6 to 12 percent
Heat rate ~28500 to 57000 BTU per kilowatt

300 C source, 40 C sink
Practical efficiency ~20 to 30 percent
Heat rate ~11400 to 17100 BTU per kilowatt