Two 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-two-inch-micro-turbine-performance-at-100-300-500-700-c.html

Updated sizing study for a two inch supercritical CO2 turbine. Estimated net 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

Scaling the one inch concept to a two inch diameter supercritical CO_2 (sCO_2) turbine increases inlet annulus area and mass flow roughly in proportion to radius, assuming the same blade height and throughflow velocity. With similar stage loading and efficiency, shaft power scales nearly linearly with radius. Below are realistic, first pass net power estimates and cycle heat rate ranges for a two inch radial inflow sCO_2 micro turbine intended to drive a small generator.

Design Basis and Scaling Notes

Turbine outer diameter: 50.8 mm (two inches)
Inlet radius: 25.4 mm
Inlet blade height: about 0.5 mm (kept the same as the one inch study)
Inlet annulus area equals 2 times pi times radius times height. Doubling radius approximately doubles flow area and mass flow for the same inlet velocity.
Inlet total pressure: about 150 bar
Representative turbine isentropic efficiency: about 70 percent
Whole cycle allowances for leakage, pressure losses, generator, and controls are included in the quoted net figures
Heat sink: about 40 C

Because we kept blade height and inlet velocity the same as in the one inch case, net power results are approximately doubled. Heat rate primarily depends on temperature lift and cycle layout, so the ranges remain similar.

Estimated Net Power Output

100 C inlet: about 12 kilowatts net
300 C inlet: about 14 kilowatts net
500 C inlet: about 16 kilowatts net
700 C inlet: about 17 kilowatts net

Notes

1. These values assume carefully designed passages for sCO_2, tight clearances, and an efficient volute and diffuser.
2. Actual allowable speed is set by rim stress and tip Mach limits; those constraints are respected in the scaling from the one inch baseline.
3. A larger diameter tends to reduce relative leakage and tip-clearance fractions, so there is modest upside beyond simple scaling if the mechanical design is optimized.

Heat Rate in BTU per Kilowatt