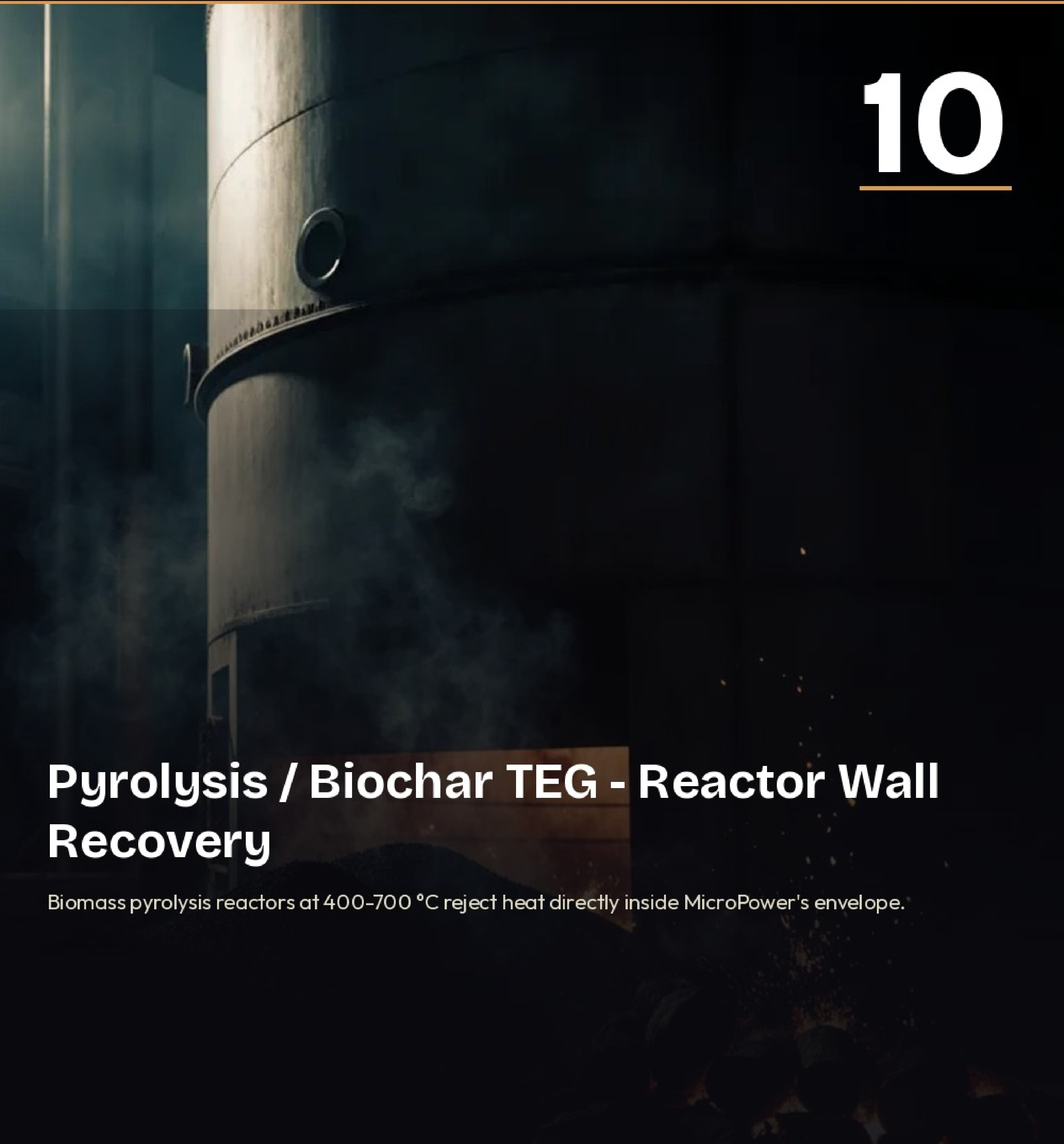
MicroPower
DEEPER LIBRARY · A MICROPOWER PUBLICATION



10

Pyrolysis / Biochar TEG - Reactor Wall Recovery

Biomass pyrolysis reactors at 400-700 °C reject heat directly inside MicroPower's envelope.

v3 · 2026-05-15 · micropower-global.com

Pyrolysis / Biochar TEG - Reactor Wall Recovery

Biomass pyrolysis reactors at 400-700 °C reject heat directly inside MicroPower's envelope.

Biomass pyrolysis reactors operate at 400–700 °C – squarely inside MicroPower's chip platform envelope. The thermal flux at the reactor wall is large, continuous, and currently rejected to ambient through cooling jackets. This note frames the recovery opportunity, the per-module performance the platform delivers today, and the deployment considerations specific to pyrolysis hardware.

1 · The pyrolysis context

Biomass pyrolysis decomposes feedstock (wood waste, agricultural residue, dedicated energy crops) under low-oxygen conditions to produce biochar and pyrolysis oils. Reactor temperatures sit in the 400–700 °C range, and the reactor wall continuously rejects heat to a cooling medium. That rejected heat is wasted in most installations because the pyrolysis process itself does not require a downstream heat consumer.

2 · The TEG recovery opportunity

MicroPower's PbTe / TAGS chip platform delivers useful conversion in this exact temperature window. Production-spec performance is 14% module conversion efficiency at 550 °C (extrapolated from ARL's evaluation of MicroPower's standard modules; independently confirmed by NREL against datasheet); installed-system efficiency after heat-exchanger losses, thermal interfaces and cold-side gradient is typically 6–10% under realistic field conditions. The chip's high-temperature contact and thermal-interface structures were informed by an early MicroPower collaboration with the U.S. Army Research Laboratory and have been substantially evolved internally since.

PowerBlock flat-plate or PowerRing pipe-wrap modules mounted on or around the reactor wall capture the rejected heat as electricity, offsetting parasitic loads (feedstock conveyors, blowers, instrumentation) or feeding back to the local grid. MicroPower's separately patented MBE-grown energy-sorting barrier-layer architecture multiplies chip-level power density 1.5–1.8× on top of the baseline platform; that figure is from internal MicroPower lab measurement on the prototype barrier layer and is on the post-funding production roadmap, not in production-spec modules today.

3 · Practical deployment considerations

Reactor-wall mounting geometry varies by pyrolysis vendor and reactor design (rotary kiln, auger, fluidised bed, fixed bed). PowerBlock flat-plate geometry suits flat reactor walls; PowerRing pipe-wrap geometry suits cylindrical reactor sections and exhaust ductwork. Cold-side cooling is typically straightforward in pyrolysis facilities because cooling water or ambient air is already available.

The economic case turns on three drivers: reactor continuous-operation duty cycle (biochar plants run near-continuously when feedstock supply is reliable), the avoided cost of grid electricity or diesel-genset parasitic power, and any biochar carbon-credit revenue stream that pyrolysis-plant economics may already depend on.

4 · Status and reference applications

Pyrolysis recovery is a credible adjacency on MicroPower's waste-heat platform. There is no current MicroPower commercial pilot in this segment. The active reference application is CS-A Gerdau Manitoba on EAF cooling duct (real, validated, 2,500+ hours of runtime); CS-C BrasilGTW is a reference application engineered for a 200 kW genset exhaust that did not materialise due to COVID. A pyrolysis pilot would naturally follow on from these references with a biomass-sector integration partner.

MicroPower engages with pyrolysis and biochar plant designers, integrators, and biomass-sector partners interested in first-deployment TEG integration on reactor walls or exhaust pipework. Introductions and structured enquiries are welcome via the MicroPower Global contact page.

References

International Energy Agency. Bioenergy Technology Roadmap (2017).

International Biochar Initiative. Biochar Production and Use Reference (2024).

Bridgwater, A. V. "Review of fast pyrolysis of biomass and product upgrading." Biomass and Bioenergy 38, 68–94 (2012).

Champier, D. "Thermoelectric generators: a review of applications." Energy Conversion and Management 140, 167–181 (2017).

 The 14% module conversion efficiency figure is for the production PbTe / TAGS platform at 550 °C (extrapolated from ARL's evaluation of MicroPower's standard modules; NREL independently confirmed production modules met datasheet specification). The 1.5–1.8× barrier-layer multiplier is from internal MicroPower lab measurement on the prototype barrier layer and is on the post-funding production roadmap. CS-A Gerdau is a validated deployment; CS-C BrasilGTW is a reference application engineered but not deployed. Contact MicroPower via www.micropower-global.com/contact for site-specific modelling.