CS-B

CMC Steel Texas: 112.5 GWh of Heat Down the Drain

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Commercial Metals Company has been in multi-year technical dialogue with MicroPower on recovering waste heat from electric-arc-furnace mini-mills. This case study sets out the energy-balance audit conducted on CMC Steel Texas at Seguin, and why thermoelectric recovery is the credible candidate for the mini-mill segment where ORCs stop being economic.

At a glance

Parameter	Value
Site	CMC Steel Texas, Seguin, TX (1 Steel Mill Dr., Seguin, TX 78155)
Production	~1,000,000 tons liquid steel per year
Heat batch size	123 tons per heat
Duration of audit window	102-minute period, 2 heats
Energy to cooling ducts in window	28,340 kWh
Average power loss to cooling water	16.7 MW
Annual waste heat to cooling water	112.5 GWh/year (112.5 kWh/ton)
Number of water-cooled ducts measured	12
CMC global capacity	~6 million tons per year
50% recovery scenario	~66 GWh/year across global fleet

1 · The partner and the site

Commercial Metals Company (CMC) is one of the largest recycled-steel producers in North America, operating electric-arc-furnace (EAF) mini-mills across the United States and internationally. The CMC Steel Texas facility at 1 Steel Mill Drive, Seguin, Texas, is the site on which the energy-balance audit described here was conducted. CMC global capacity is approximately 6 million tons of liquid steel per year across the fleet.

CMC and MicroPower have been in technical dialogue for several years, meeting multiple times over the past two years as of the audit. CMC's interest is driven by the economics of EAF mini-mill waste-heat

recovery: ORCs, the incumbent alternative, have been installed in a few steel mini-mills, but costs run high for efficiency that typically sits below 15%. The mini-mill segment is precisely where ORC economics thin out, and where CMC believes thermoelectric recovery has a credible claim.

2 · The energy balance the audit revealed

CMC's EAF energy-balance model for a high-carbon, high-oxygen-input steelmaking process indicates a total energy input of approximately 800 kWh per ton of liquid steel. Of that, only about 40% goes into the liquid steel itself. Approximately 44% of the total energy input – 352 kWh per ton – leaves the furnace in the off-gas and must be treated.

The audit logged energy transferred to the cooling water across 12 water-cooled ducts during the production of two heats of 123 tons each. Over the 102-minute production window, the cumulative energy transferred to the ductwork was 28,340 kWh – which translates to an average power loss to the cooling water of 16.7 MW. Scaled up against annual production of approximately 1 million tons at Seguin, the result is 112.5 kWh per ton of liquid steel, or 112.5 GWh of energy sent into cooling water every year – at a single site.

A more aggressive CMC-internal model (per-heat loss of ~28 MWh, annualising to ~228 GWh/year on the 1 Mt Seguin capacity) would scale a 50% thermoelectric recovery to over 11 GWh annually at Seguin alone. Against CMC's 6 Mt global capacity, a 50% recovery fleet rollout would generate on the order of 66 GWh annually.

3 · Why thermoelectric, not ORC

Integrated steel mills have for decades converted their waste heat to steam and used that steam to turn turbines. Mini-mills rarely have a steam infrastructure, and they do not generate nearly as much waste heat as the integrated mills, so steam-Rankine waste-heat recovery is not a practical candidate for the mini-mill segment. Organic Rankine Cycle has been tried, but the economics at mini-mill scale thin out quickly as ORC capital intensity does not scale down in proportion to electrical output.

CMC's reasoning on MicroPower specifically – drawn from the R1 audit document and now referenced across MicroPower's steel-sector dialogue – rests on four practical considerations:

- The MicroPower chip delivers higher energy output than other commercial thermoelectric products, with improved tolerance for the thermal cycling typical of EAF duct environments.
- MicroPower has an established working relationship with Texas State University, its professors, students, and laboratories.
- The MicroPower facility is geographically close to CMC Steel Texas, which enables close collaborative work on physical pilot engineering.
- MicroPower is simultaneously working with other high-temperature industries (cement kilns, general industrial), so the technology platform has broad support beyond any single sector.

4 · Where a pilot would land

Mini-mills carry significant electrical load at low and medium voltages – directly suitable for the DC or post-conditioning output of a thermoelectric waste-heat-recovery system. The water-cooled ductwork of every EAF direct-evacuation system is in effect a large heat-transfer apparatus that can be augmented with thermoelectric modules integrated into the duct wall.

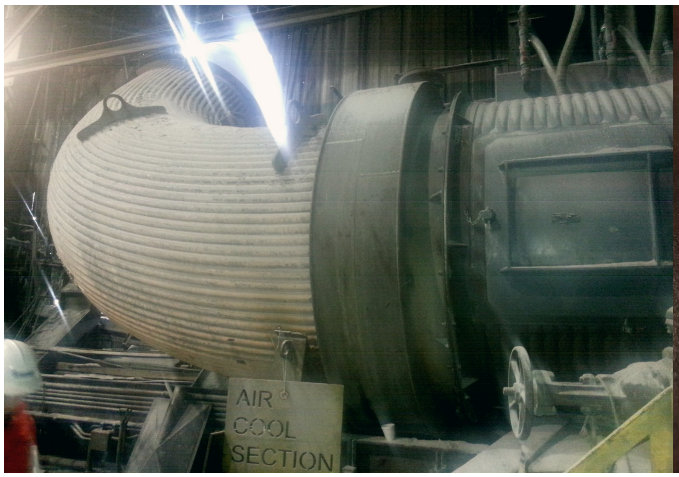
The retrofit geometry MicroPower has validated in the Gerdau Manitoba pilot (CS-A) – access-hatch-mounted PowerBlock arrays on the cooling duct upstream of the recuperator – is directly portable to the CMC Seguin site. Commercial-scale deployment at CMC would extend the audit from measurement-only to first commercial generation. Scale-up potential across the CMC global mini-mill fleet is quantified above.

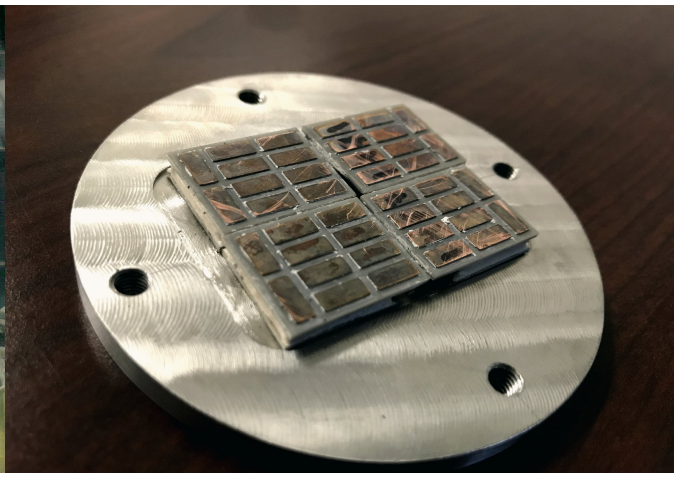
5 · Why this case study matters

The CMC audit is the clearest single-document quantification of the waste-heat opportunity at an EAF mini-mill that MicroPower has in its customer record. It does not report a deployment – no PowerBlocks have been installed at CMC Seguin yet – but it does report a customer-engineering team's own numerical judgement of the recoverable energy at their site. Two of those numbers (16.7 MW average, 112.5 GWh/year) anchor the MicroPower steel-sector narrative; both come from CMC's own measurement, not MicroPower modelling.

Closing

A pilot at Seguin was the proposed next step, using the same access-hatch-mounted PowerBlock architecture validated at Gerdau Manitoba, scaled for the CMC measurement protocol and access constraints. That step was not taken: MicroPower did not have the manufacturing capability or the capital to carry the engagement into a commercial install, and subsequently wound down active operations. The audit and the validation work stand, and resuming the engagement is part of what the company's reactivation is intended to make possible – it did not stall on any customer decision.





Sources & notice

Sources: Waste Heat Recovery at MiniMills Using Advanced Thermoelectric Technology from MicroPower Global Limited, CMC Americas, Seguin, TX (Revision 1 document). Energy-loss quantification: MicroPower CMC Energy Loss presentation. Both archived in the MicroPower customer records.