RABATEC

Sainte-Julie, Québec



FURNACE ASSET MANAGEMENT

Furnace investment and operating performance

CAPEX Compare repair, reline and replacement options. Carry the investment case through installation and commissioning.

OPEX Work on shift with operators to spot wear, teach inspection practices and track campaign life, availability and cost per tonne.

Your project lead

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Français

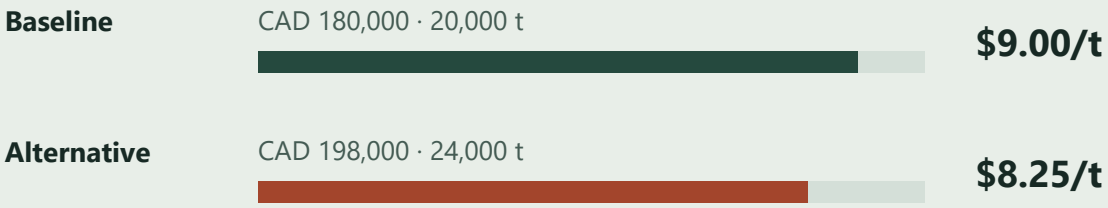
FURNACE ECONOMICS

What does a campaign really cost?

A bid gives you an installed price. Production records tell you how many tonnes that lining actually delivered. Comparing both can change a purchasing decision.

FIGURE 1 / ILLUSTRATIVE CAMPAIGN COMPARISON

Installed lining cost per tonne produced



The alternative costs 10% more to install. It must exceed 22,000 t to beat the baseline. At 24,000 t, the lining cost is 8.3% lower per tonne.

Assumptions in Canadian dollars. Only installed lining cost is included. Energy, downtime, repairs and metal recovery require separate site data.

What to measure alongside cost

Availability	Log unplanned outage hours and scheduled hours. Separate lining-related stops from upstream delays.
Metal recovery	Compare metal recovered with metal charged over the same period. Reconcile slag assays and inventory changes.
Energy intensity	Track energy per tonne at comparable duty. Review holding time, shell temperatures and lining changes before attributing a gain.

Process heating reference · U.S. Department of Energy

CAPEX / FURNACE ASSET MANAGEMENT

Feasibility through commissioning

Identify the assumptions that justify the investment. Carry them into the tender, field inspections and start-up acceptance record.

01 Feasibility and capital prioritization

Compare repair, reline and replacement against asset condition, outage windows and production demand. Test how campaign life, downtime and installation cost affect the return.

You receive a ranked capital plan and a comparison of lifecycle cost, payback assumptions and the risks that could change the decision.

02 Furnace and lining design review

Review drawings against duty, geometry, bath and slag exposure, insulation, joints, anchoring, access and maintainability. Identify the interfaces that need resolution before procurement.

You receive a marked-up design review, open-issues register and acceptance criteria for each critical zone.

03 Heat-transfer simulation

Compare lining options at steady state and through heat-up or cooling. Use agreed conductivity data, geometry, boundary conditions and operating history. Check how uncertainty affects the result.

You receive predicted shell temperatures, heat loss and temperature profiles by zone, with assumptions, sensitivities and a recommendation on thickness or insulation.

04 Refractory selection and qualification

Match the working lining, backup and insulation to chemical attack, abrasion, thermal cycling and installation constraints. Compare candidate grades against the material already in service.

You receive a zone-by-zone material schedule, technical specifications and a qualification plan for substitutions.

05 Manufacturer negotiation and procurement

Prepare the technical RFQ, normalize supplier bids and support negotiations on grade equivalence, inspection, lead times, traceability and warranty terms. Your team approves the commercial award.

You receive a comparable bid sheet, documented exceptions and a negotiation brief showing price, delivery and lifecycle trade-offs.

06 Installation, commissioning and handover

Agree inspection hold points with the contractor. Document installation, curing and dry-out, then verify start-up conditions against the acceptance criteria with the site team.

You receive an inspection record, a list of outstanding items and a commissioning baseline for the operating team.

OPEX / FURNACE ASSET MANAGEMENT

Operating costs and asset performance

Walk the furnace with the people who run it. Pair their observations with cost and wear records to choose a change, try it on shift and decide whether to extend it to other crews.

01 Operating cost and KPI management

Track refractory cost per tonne, furnace availability, energy per tonne and campaign life against the investment case. Review deviations with operations and maintenance before attributing a change to the lining.

You receive a site scorecard with baselines, review intervals and triggers for inspection, repair or reline planning.

02 Campaign monitoring and failure analysis

Map wear and hot spots by zone. Reconcile repair history and operating events with visual inspections, thermal surveys and post-mortem samples. Identify the evidence that would distinguish likely causes.

You receive a condition baseline, an inspection schedule and a repair, reline or operating recommendation with its limits.

03 Metallurgical analysis and operating trials

Reconstruct heats from plant records, feed, slag and metal assays. Investigate foaming, endpoint control, losses, energy use and lining attack. Compare operating changes under agreed constraints.

You receive a process baseline and mass or energy balance where data permit, followed by a trial plan with sampling points, success measures and stop criteria.

04 Operator coaching on the furnace floor

Join crews on their rounds. Ask where wear first appears and what gets missed at shift change. Use examples from their own furnace to practise recognizing deterioration, recording it consistently and knowing when to call maintenance.

You receive a shift checklist written with operators, photographs of site examples and a handover exercise for crew leads.

05 Putting refractory practices into daily use

Choose one recurring issue with operators and supervisors. Trial a change on one shift, hear what made it easier or harder, and coach the other crews on the agreed practice. Compare wear and downtime under similar operating conditions.

You receive a site-approved work instruction, a named owner and a follow-up review to decide whether to keep, adapt or stop the change.

SERVICE 02 / APPLIED R&D AND TESTING

Qualify a change before a plant trial



FIGURE 2 / SCHEMATIC

A section through the hot face



- Slag at the hot face
- Reaction zone
- Refractory matrix

Will a different refractory better resist your slag?

A useful comparison starts with the incumbent grade and an agreed decision criterion. Here is how we would structure a refractory–slag investigation.

01	**Define the exposure**	Select the reference and candidate. Agree on slag chemistry, specimen geometry, temperature, atmosphere and exposure time.
02	**Measure the damage**	Section the specimens. Compare penetration depths and reaction zones against the reference using microscopy and elemental maps where useful.
03	**Decide on a trial**	Receive the comparison, variability and limits. If the result warrants a plant trial, agree on the zone, operating window, inspections and stop criteria.

We coordinate specialist facilities. Your written proposal confirms the instrument, preparation, test conditions, responsibilities, timing and price after qualification.

TESTING CATALOGUE

Materials, loading and defects

Failure analysis and material identification

Why did the lining or component deteriorate?

Fracture and reaction-zone mapping Hitachi SU-8230 field-emission SEM with Bruker XFlash EDS	Micrographs and elemental maps showing how a damaged region differs from a reference.
Crystalline phase identification PANalytical X'Pert PRO X-ray diffractometer (XRD)	Diffraction patterns and identified crystalline phases in deposits, starting material or reaction products.
Refractory–slag penetration comparison (custom study) Controlled-atmosphere tube furnace and polished-section microscopy	A comparison of penetration depths and reaction zones for candidate linings at the agreed temperature and exposure time.

Mechanical and high-temperature performance

Which material withstands the specified load or heat cycle?

Tension and compression 200 kN universal test frame	Load–displacement or stress–strain curves and agreed strength measures for comparable specimens.
Hot deformation Gleeble 3800 thermomechanical simulator	Flow stress versus strain for selected temperatures and strain rates to compare forming conditions.
Dilatometry DIL805 A/D dilatometer	Dimensional change through heating and cooling, including detectable transformation intervals.
Thermogravimetry and differential thermal analysis Combined DTA/TGA system	Mass change and thermal events as a function of temperature under the agreed atmosphere.

Dimensional inspection and internal defects

Is the part within tolerance, and are hidden defects present?

Coordinate inspection Mitutoyo Bright Strato 7106 coordinate measuring machine (CMM)	Measured feature positions and dimensional deviations relative to the drawing datums.
Surface roughness Mitutoyo SJ400 contact profilometer	A surface trace and specified roughness parameters for the functional surface.
Nondestructive internal inspection Nikon XT H 225 X-ray micro-CT system	Reconstructed sections and internal void distribution, subject to part size, density and achievable resolution.

TESTING CATALOGUE

Processing, acoustics and heat

Powder and polymer processing

Will a new batch or formulation process consistently?

Powder flow Freeman FT4 powder rheometer	Relative flow-energy results under a defined conditioning sequence for comparing powder lots.
Melt rheology Rotational and capillary rheometers	Viscosity versus shear rate or frequency for comparing processing windows.
Formulation trials Extruders and an injection-moulding machine	Trial specimens and a record of processing conditions for follow-up dimensional or mechanical comparison.

Noise and acoustic insulation

Which panel or enclosure treatment reduces noise in the target band?

Absorption and transmission Normal-incidence impedance tubes	Frequency-dependent absorption coefficients or transmission loss for material specimens.
Enclosure leakage mapping Coupled acoustic chambers and I-Track sound-intensity probe	A map identifying dominant sound-transmission paths and candidate modifications.

Thermal insulation and energy use

Where is energy being lost and which insulation option helps?

Thermal conductivity C-Therm Trident thermal conductivity analyzer	Conductivity values for suitable samples over an agreed temperature range.
Assembly thermal resistance Calibrated hot box and FluxTeq PHFS-09e heat-flux sensors	Heat-flow data and a thermal resistance comparison for wall or insulation assemblies.
Electrical load profile Fluke 1730 three-phase energy logger	A time-resolved demand and energy profile across representative operating cycles.

TESTING CATALOGUE

Coatings, pavements and ground

Electronics and functional coatings

Does the prototype meet its electrical or coating specification?

Sheet resistance Four-point probe	Sheet resistance of a suitable conductive film for comparing lots or deposition settings.
Surface and film step height Ambios XP-200 stylus profilometer	A surface-height trace and step-height measurement across a prepared film edge.
RF component response E5061 vector network analyzer	Reflection and transmission versus frequency for a compatible component and fixture.

Pavement and aggregate durability

How will a change in mix, binder or aggregate affect performance?

Rutting susceptibility MLPC wheel tracker	Rut depth against loading cycles for comparing compacted mixes.
Low-temperature binder response Cannon TE-BBR bending beam rheometer	Creep stiffness under specified temperature and loading conditions.
Aggregate wear Micro-Deval abrasion apparatus	Mass loss after a controlled abrasion cycle for comparing aggregates.

Rock and soil behaviour

What strength or shear behaviour should guide material selection?

Rock discontinuity shear GCTS RDS-200XL direct-shear machine	Shear stress–displacement response under agreed normal loading.
Rock compression Uniaxial compression press	Unconfined compressive strength of prepared rock cores.
Soil or granular material shear 100 × 100 mm direct-shear box	Peak shear resistance at selected normal stresses for the specified material condition.

YOUR PROJECT LEAD

Yassine Douche

Yassine brings 20 years of industrial technical and commercial experience. He has led a North American refractory portfolio supporting aluminum, copper, nickel and lead operations. His field work includes smelter operating reviews, refractory selection, supplier negotiations, installation quality assessments and post-mortem investigations.

He holds a Master of Applied Science in Metallurgical Engineering. His master's research examined the impact resistance of aluminosilicate refractory castables. He is a PhD candidate in Mechanical Engineering. His research examines refractory wear in nickel smelting and converting, and how to control slag foaming during carbon reduction in nickel converters.

API 936 Refractory Personnel
Certified through August 31, 2028.

View credential

Lean Six Sigma Black Belt
Issued by Six Sigma Global Institute.

View credential

M.A.Sc. in Metallurgical Engineering
Research on impact damage in refractory castables.

View thesis record

DISCUSS A PROJECT

What decision does your team need to make?

Email Yassine a short, non-confidential description of the furnace, material or process, the evidence available and your decision date. We will qualify the scope before pricing the work.

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