CementAI™ Plant Savings Report

Source: Sample Plant Data — Rajasthan Works (Demo) | Data period: 01 Jun 2026 to 30 Jun 2026 | 30 days analysed | Generated: 16 Jul 2026 10:29 UTC | Upload #05CB1A42

IDENTIFIED SAVINGS OPPORTUNITY

Rs. 83.56 Cr / year

Rs. 6.96 Cr per month

Module KPI Scorecard

Module	Metric	Actual	Target	Gap	Status	Monthly Opp.
Kiln	Heat Consumption	758.4 Kcal/Kg	720 Kcal/Kg	+38.4 (+5.3%)	CRITICAL	Rs. 1.10 Cr
Kiln	Clinker Production	3845 TPD	4000 TPD	-155 (+3.9%)	WARNING	-
Lab / Quality	Free Lime	1.75 %	1.5 %	+0.25 (+16.7%)	WARNING	Rs. 7.3 L
Lab / Quality	28-Day Strength	54 MPa	53 MPa	+1 (+1.8%)	CRITICAL	-
Energy	Specific Power	86.5 kWh/T	82 kWh/T	+4.5 (+5.5%)	WARNING	Rs. 42.2 L
Energy	Power Factor	0.885 PF	0.95 PF	-0.065 (-6.8%)	WARNING	Rs. 50,000
Production	Kiln Availability	91.5 %	95 %	-3.5 (-3.7%)	WARNING	Rs. 98.0 L
Production	Mill Availability	91.2 %	92 %	-0.8 (-0.9%)	WARNING	-
Raw Mill	Raw Mill Feed Rate	168.1 TPH	210 TPH	-41.9 (+19.9%)	CRITICAL	Rs. 35.5 L
Raw Mill	Throughput Loss	168.1 TPH	189.8 TPH	-21.7 (+11.5%)	WARNING	Rs. 7.1 L
Cement Mill	Cement Mill Specific Energy	33.6 kWh/T	30 kWh/T	+3.6 (+12.1%)	WARNING	Rs. 13.4 L
Cement Mill	Cement Mill Feed Rate	79.4 TPH	105 TPH	+25.6 (+24.4%)	CRITICAL	Rs. 1.80 Cr
Coal Mill	Mill Throughput	26.8 TPH	32 TPH	+5.2 (+16.3%)	WARNING	-
Crusher	Crusher Feed Rate	382 TPH	750 TPH	+368 (+49.1%)	WARNING	Rs. 36.8 L
Packing	Bag Rejection	2.08 %	0.5 %	+1.58 (+316.6%)	WARNING	Rs. 37.5 L
Environment	NOx	786 mg/Nm³	400 mg/Nm³	+386 (+96.6%)	CRITICAL	Rs. 50.2 L
Carbon	CO■ Intensity	775 Kg/T	650 Kg/T	+125 (+19.2%)	CRITICAL	Rs. 78.2 L

Prescriptive Actions (ranked by priority)

1. [CRITICAL] Bearing inspection required — Clinker Cooler Fan 3 — **Rs. 5.06 Cr/month** (confidence 77%)

54 vibration readings above 8 mm/s detected on Clinker Cooler Fan 3. Trend indicates progressive bearing degradation. Failure within 7–14 days if unaddressed. CM2 downtime = 2–3 days → Rs. 337L in lost production.

Action: Schedule bearing inspection within 48 hours; prepare replacement bearing kit

2. [CRITICAL] Bearing inspection required — RM2 Main Motor — **Rs. 5.06 Cr/month** (confidence 77%)

12 vibration readings above 8 mm/s detected on RM2 Main Motor. Trend indicates progressive bearing degradation. Failure within 7–14 days if unaddressed. CM2 downtime = 2–3 days → Rs. 337L in lost production.

Action: Schedule bearing inspection within 48 hours; prepare replacement bearing kit

3. [HIGH] Reduce CO from 600 to below 200 ppm — **Rs. 68.5 L/year** (confidence 72%)

Elevated CO indicates incomplete combustion — fuel is being wasted. Check coal fineness (R90), burner pipe alignment, and primary air ratio.

Action: Check coal mill fineness (target R90 <15%); optimize burner pipe axial position; reduce primary air

4. [HIGH] Reduce heat consumption by 28 Kcal/Kg — **Rs. 13.17 Cr/year** (confidence 84%)

Average heat: 758.4 vs target 720 Kcal/Kg. Breakdown: O■ excess 5, CO 2.0, cooler 0.0, other 31.9 Kcal/Kg.

Action: Target O■ at 2.5%, CO below 200 ppm, secondary air above 1000°C

5. [HIGH] RM1: Trim mill outlet temp from 184°C toward 90-120°C — **Rs. 1.36 Cr/year** (confidence 73%)
Outlet averages 184°C — above the 90-120°C drying window for 3.8% feed moisture. Excess hot gas draw loads the mill fan (~1.3 kWh/T) and steals preheater heat the kiln has to replace.
Action: Close the hot gas damper toward the temperature setpoint; increase fresh feed or recirculation; verify the outlet temp control loop is in auto

6. [HIGH] RM2: Reduce specific energy from 40.2 to 22 kWh/T — **Rs. 15.09 Cr/year** (confidence 81%)
Grinding energy averages 40.2 kWh/T vs the 22 kWh/T target. Feed moisture 7.6% and grinding-bed condition are the usual levers.
Action: Reduce feed moisture (stockpile rotation); optimize separator speed; check grinding pressure profile and dam ring

7. [HIGH] RM2: Cut feed moisture from 7.6% toward 5% — **Rs. 2.60 Cr/year** (confidence 76%)
Feed moisture averages 7.6%; each 1% above 5% costs ~1.2 kWh/T in drying and throttles throughput ~8%. Root causes are usually uncovered stockpiles and poor pile rotation in monsoon.
Action: Rotate stockpile draw to drier piles; cover/reclaim wet zones last; pre-blend high-moisture additives

8. [HIGH] CM1: Reduce specific energy from 38.2 to 30 kWh/T — **Rs. 3.13 Cr/year** (confidence 79%)
Grinding energy averages 38.2 kWh/T vs the 30 kWh/T OPC target. Check ball charge gradation, separator settings, and whether Blaine is over-spec.
Action: Audit ball charge (add high-chrome media); optimize separator cut size; reduce Blaine target if over-designed

9. [HIGH] Address mill fire risk — CO 271 ppm, risk score 25 — **Rs. 50.2 L/year** (confidence 66%)
Elevated CO / fire-risk score in the coal mill circuit indicates smoldering deposits or hot-gas excursions. Beyond safety, a mill fire forces a kiln stop on fuel starvation.
Action: Purge and inspect mill internals and bag filter; verify inertization (CO■/N■) readiness; keep outlet temp <90°C; clear dead-stock pockets

10. [HIGH] Cut preheater CO from 800 ppm to below 200 — **Rs. 1.03 Cr/year** (confidence 72%)
CO at the preheater averages 800 ppm — unburnt fuel leaving the calciner and a CO-trip risk for the ESP/bag filter. Usual causes: poor calciner fuel-air mixing, coarse fuel, or false air at the riser.
Action: Rebalance tertiary air vs calciner fuel; check fuel splitter wear; seal riser and flap-valve false air

11. [HIGH] Inspect cooler fan 3 — vibration 4.8 mm/s — **Rs. 0/month** (confidence 75%)
Fan 3 vibration averages 4.8 mm/s (ISO 10816 alarm at 4.5). An unplanned cooler fan failure forces a kiln stop.
Action: Balance/align fan 3 at next opportunity; check bearing condition and foundation bolts

12. [HIGH] Increase AFR TSR from 8% to 15% — **Rs. 100.69 Cr/year** (confidence 80%)
Each % TSR increase displaces ~Rs. 461/month in coal cost. Current TSR 8% vs target 15%.
Action: Install AFR feeding system at calciner; secure RDF/biomass supply contracts; upgrade preheater for higher AFR

13. [MEDIUM] Reduce kiln exit O■ from 3.4% to 2% — **Rs. 1.55 Cr/year** (confidence 78%)
Every 1% excess O■ above optimum costs ~5 Kcal/Kg. Current 3.4% = 5 Kcal/Kg avoidable loss.
Action: Reduce ID fan speed; check kiln hood pressure; reduce false air at inlet seal

14. [MEDIUM] Recover exhaust heat — exit gas at 262°C vs 250°C benchmark — **Rs. 62.4 L/year** (confidence 74%)
Exit gas averages 262°C; every 10°C above 250 carries ~1.5 Kcal/Kg out of the stack (~1.8 Kcal/Kg currently). Usually caused by false air, poor preheater heat exchange, or bypass losses.
Action: Seal false-air ingress at kiln inlet and preheater flaps; verify cyclone dip tubes; route surplus to WHRS/raw mill drying

15. [MEDIUM] Improve cooler recuperation — clinker leaving at 156°C — **Rs. 12.2 L/year** (confidence 72%)
Clinker outlet averages 156°C vs 150°C benchmark — heat not recuperated into secondary/tertiary air is burned again as fuel. Check grate speed vs bed depth and undergrate air distribution.
Action: Optimize cooler grate speed and air-chamber balance; inspect grate plates for fall-through

16. [MEDIUM] Push kiln feed — stable at 82/100 but 155 TPD below target — **Rs. 4.75 Cr/year** (confidence 70%)
Clinker production averages 3845 TPD vs 4000 nameplate while the stability index holds 82/100 — headroom exists for a stepped feed increase (+155 TPD shown; raise in 2-3% steps watching O■, BZT and torque).
Action: Increase kiln feed in 2-3% steps with proportional coal and ID fan trim; hold each step 4h before the next

17. [MEDIUM] Reduce average free lime from 1.75% to 1.5% — **Rs. 88.1 L/year** (confidence 79%)
Average free lime of 1.75% exceeds target of 1.5%. This increases fuel consumption and quality rejection risk. Root cause: likely coal quality variation or under-firing during night shift.
Action: Stabilise coal calorific value; avoid large feed-rate changes without fuel adjustment

18. [MEDIUM] Reduce specific power from 86.5 to 82 kWh/T — **Rs. 5.06 Cr/year** (confidence 81%)
Renewable offset: 2843 kW WHRS + 984 kW solar = 2,388,047 kWh/month savings.
Action: Optimize mill grinding; shift loads off-peak; run WHRS at full capacity during peak tariff hours

19. [MEDIUM] Improve power factor from 0.885 to 0.95 — **Rs. 6.0 L/year** (confidence 88%)
Current PF 0.885 — utility likely applies kVAR demand charges. Target 0.95 avoids ~Rs. 50,000/month in penalties.
Action: Auto-switch APFC capacitor banks; check capacitor health (ESR); add 1-2 MVAr capacitor bank if needed

20. [MEDIUM] RM1: Raise feed rate from 189 toward demonstrated 204 TPH — **Rs. 61.5 L/year** (confidence 76%)
This mill has already sustained 204 TPH in this dataset but averages 189 TPH. Feed moisture 3.8%, grinding pressure 84 bar — the gap is recoverable with setpoint discipline, not capex.
Action: Step up the feed setpoint 2-3 TPH at a time watching mill differential pressure and vibration; hold at the last stable step

21. [MEDIUM] RM1: Raise grinding pressure from 84 to 90-130 bar — **Rs. 84.7 L/year** (confidence 71%)

Hydraulic pressure averages 84 bar — below the 90-130 bar window a VRM needs for a stable grinding bed. A thin bed wastes power in vibration and recirculation and caps throughput (feed currently 189 TPH).
Action: Step up hydraulic pressure 3-5 bar at a time watching vibration; check accumulator N■ pre-charge and dam ring height

22. [MEDIUM] RM2: Trim mill outlet temp from 164°C toward 90-120°C — **Rs. 73.8 L/year** (confidence 73%)
Outlet averages 164°C — above the 90-120°C drying window for 7.6% feed moisture. Excess hot gas draw loads the mill fan (~0.9 kWh/T) and steals preheater heat the kiln has to replace.
Action: Close the hot gas damper toward the temperature setpoint; increase fresh feed or recirculation; verify the outlet temp control loop is in auto

23. [MEDIUM] RM2: Raise grinding pressure from 72 to 90-130 bar — **Rs. 66.5 L/year** (confidence 71%)
Hydraulic pressure averages 72 bar — below the 90-130 bar window a VRM needs for a stable grinding bed. A thin bed wastes power in vibration and recirculation and caps throughput (feed currently 148 TPH).
Action: Step up hydraulic pressure 3-5 bar at a time watching vibration; check accumulator N■ pre-charge and dam ring height

24. [MEDIUM] RM2: Adjust separator speed from 106 toward 85-95 RPM — **Rs. 66.4 L/year** (confidence 72%)
Separator averages 106 RPM. Off-optimum speed over-recirculates material (~0.8 kWh/T) or coarsens the raw meal, hurting kiln burnability.
Action: Move separator speed 2-3 RPM at a time toward 90 RPM, checking residue on the next lab sample before the next step

25. [MEDIUM] Review Blaine target — 3341 cm²/g costs ~3.4 kWh/T extra — **Rs. 1.52 Cr/year** (confidence 72%)
Average Blaine 3341 cm²/g vs a 3000 baseline; every 100 above adds ~1 kWh/T of grinding power. If strength results have margin over spec, part of this fineness is unsold quality.
Action: Compare 28-day strengths against spec margin; lower separator cut/Blaine setpoint in 25 cm²/g steps with QC signoff

26. [MEDIUM] CM1: Reduce water injection — mill outlet only 68°C — **Rs. 11.5 L/year** (confidence 70%)
Outlet temp averages 68°C with 622 L/hr water injection. Below 90°C gypsum does not dehydrate consistently, risking erratic setting times, while the spray and extra venting waste power.
Action: Cut water injection stepwise targeting 90-105°C outlet; verify cement temp downstream and setting-time trend with QC

27. [MEDIUM] CM2: Reduce water injection — mill outlet only 82°C — **Rs. 15.4 L/year** (confidence 70%)
Outlet temp averages 82°C with 982 L/hr water injection. Below 90°C gypsum does not dehydrate consistently, risking erratic setting times, while the spray and extra venting waste power.
Action: Cut water injection stepwise targeting 90-105°C outlet; verify cement temp downstream and setting-time trend with QC

28. [MEDIUM] Restore coal mill margin — 26.8 vs 32 TPH capability — **Rs. 0/month** (confidence 69%)
Mill throughput averages 26.8 TPH against a 32 TPH benchmark. Thin fuel-supply margin caps kiln feed increases and forces conservative operation whenever the fine-coal bin runs low.
Action: Check feeder calibration and mill DP; review hot gas availability for drying; schedule wear-parts inspection

29. [MEDIUM] Improve mill drying efficiency — 82.5% vs 85% benchmark — **Rs. 43.3 L/year** (confidence 68%)
Drying efficiency averages 82.5%; the shortfall means hot gas heat is vented rather than removing coal moisture, and residual moisture penalizes burner performance.
Action: Verify hot gas damper control and duct leaks; balance gas flow vs feed moisture; check mill inlet seal

30. [MEDIUM] Reduce coal mill specific power from 22.4 to ~19 kWh/T — **Rs. 51.4 L/year** (confidence 72%)
Grinding power averages 22.4 kWh/T vs the 18-20 kWh/T window for a coal VRM. Usual causes: worn rollers/table liners, low grinding pressure, or over-fine product for the burner's needs.
Action: Inspect roller/table wear; verify grinding pressure and dam ring; align fineness target to burner spec (R90 12-15%)

31. [MEDIUM] Tighten coal fineness — R90 at 16.4% vs 15% limit — **Rs. 96.1 L/year** (confidence 70%)
Residue on 90µm averages 16.4%. Coarse coal burns late and incompletely, raising kiln CO and heat consumption (~2 Kcal/Kg per 1% R90 above target).
Action: Increase separator speed stepwise; check classifier blades for wear; balance against mill differential pressure

32. [MEDIUM] Raise calcination degree from 91.2% toward 92-95% — **Rs. 10.8 L/year** (confidence 71%)
Meal enters the kiln 3.8% short of full calcination, forcing the burning zone to finish the job at higher fuel cost. Check calciner fuel split, meal distribution, and stage-4/5 heat exchange.
Action: Shift 1-2% of fuel to the calciner; verify meal splitter flap positions; inspect stage-5 dip tube integrity

33. [MEDIUM] Recover tower efficiency — 84.2% vs 86% benchmark — **Rs. 2.34 Cr/year** (confidence 68%)
Preheater thermal efficiency averages 84.2%. Each point below benchmark is ~7.5 Kcal/Kg of extra fuel. Typical losses: cyclone dip-tube damage, meal short-circuiting, radiation from worn refractory.
Action: Survey cyclone dip tubes at next stop; thermography for shell hot spots; verify stage-wise ΔT profile against commissioning data

34. [MEDIUM] Trim preheater exit gas from 346°C toward 330°C — **Rs. 81.9 L/year** (confidence 70%)
Stage-5 exit gas averages 346°C vs ~310-330°C for a 5-stage tower — heat leaving unused. Check heat exchange per stage and consider WHRS/raw-mill drying use.
Action: Check meal distribution boxes and stage feed pipes; route surplus heat to WHRS or drying

35. [MEDIUM] ID fan at 92% — de-bottleneck before pushing feed — **Rs. 0/month** (confidence 70%)
ID fan speed averages 92% — little margin for feed increases or upset recovery. High draft demand often traces to false air or pressure drop buildup.
Action: False-air survey (O■ rise across tower); clean/inspect cyclone inlets; review fan impeller condition

36. [MEDIUM] Lift cooler efficiency from 68.4% toward 72%+ — **Rs. 1.47 Cr/year** (confidence 73%)
Cooler efficiency averages 68.4% — heat not returned as secondary/tertiary air must be bought again as fuel (~1.2 Kcal/Kg per point). Levers: bed depth via grate speed, chamber air balance, clinker granulometry.

Action: Run bed-depth optimization (slower grate, deeper bed); rebalance undergrate fans chamber-by-chamber; check for red-river patterns

37. [MEDIUM] Raise secondary air temp from 1032°C toward 1050°C+ — **Rs. 49.6 L/year** (confidence 70%)
Secondary air averages 1032°C; every 10°C below 1050 costs ~0.8 Kcal/Kg of kiln fuel. Points to shallow bed or excessive cooling air in the recuperation zone.
Action: Deepen the bed in chambers 1-2; trim first-chamber air toward recuperation; verify kiln-hood seal

38. [MEDIUM] Cool clinker discharge from 148°C toward 125°C — **Rs. 39.3 L/year** (confidence 69%)
Clinker leaves at 148°C average — unrecovered heat plus stress on conveyors and downstream cement temperature. Check late-chamber air distribution and grate plate condition.
Action: Increase late-chamber cooling air; inspect grate plates for fall-through; verify clinker breaker gap

39. [MEDIUM] Reduce clinker factor from 0.72 to 0.65 — **Rs. 21.05 Cr/year** (confidence 82%)
Every 0.01 reduction saves Rs. 14000/T in material cost. Target 0.65 achievable with slag/fly ash blending.
Action: Increase slag addition (max 50% for PSC); add fly ash silo capacity; optimize gypsum content

Operational Events Detected

• Excess kiln exit O■ at 3.4% — opportunity: reduce to 2% to save Rs. 12.9L/month
• High free lime episode: 8 lab samples above 2.0% — coal calorific value or feed-rate issue suspected
• Vibration spike on Clinker Cooler Fan 3: 54 readings above 8 mm/s
• Vibration spike on RM2 Main Motor: 12 readings above 8 mm/s
• Limestone inventory below optimal: 22427T

Cost Assumptions

Coal: Rs. 12,000/T @ 4,200 Kcal/Kg | Power: Rs. 7.50/kWh | Cement: Rs. 3,500/T | Clinker: Rs. 2,800/T | 26 working days/month (editable in Settings → Plant Costs)