

PEMS vs. CEMS — Total Cost of Ownership

The Complete Financial and Operational Case for Predictive Emissions Monitoring

Trace Environmental Systems Inc. | North America

IMPORTANT — RATA REQUIREMENTS UNDER PEMS:

PEMS does not eliminate Relative Accuracy Test Audit (RATA) obligations. Under 40 CFR Part 75 Subpart E, an annual RATA validates ongoing PEMS model accuracy. equivalent QA requirements apply.

What PEMS changes: fewer discrete test events (single model validation vs. multi-analyzer RATA schedule), no flow monitor RATA (PEMS does not use a stack flow monitor), and lower failure risk (model-based approach not subject to analyzer drift or hardware degradation).

What PEMS fully eliminates: calibration gas costs, analyzer hardware maintenance, probe and sample line maintenance, spare parts, redundant equipment, calibration manifolds, CEMS rack, and sample conditioning system costs.

SECTION 1 — ANNUAL O&M COST COMPARISON (Per Monitored Unit)

Cost Category	Traditional CEMS (Annual, Per Unit)	Trace PEMS (Annual, Per Unit)	Notes
Analyzer hardware maintenance & parts	\$15,000 – \$30,000	\$0	PEMS has no analyzer hardware. Eliminates all probe, optic, pump, and component maintenance.
Calibration gas & consumables	\$8,000 – \$12,000	\$0 daily calibration (fully eliminated)	PEMS uses process parameters, not bottled reference gases. Zero daily calibration gas cost.
RATA testing — 3rd party firm	\$12,000 – \$40,000	\$8,000 – \$20,000 (reduced, not eliminated)	Single model validation replaces multi-analyzer per-unit RATA schedule. No stack flow monitor RATA required.
Shelter / enclosure HVAC & utilities	\$3,000 – \$8,000	\$0	PEMS requires no analyzer shelter, no climate control, no dedicated electrical.
Unplanned downtime / data substitution cost	\$5,000 – \$25,000	~\$0	PEMS data availability approaches 100%. No hardware failure modes that cause data gaps.
CEMS technician labor	\$15,000 – \$40,000	\$2,000 – \$5,000	PEMS requires periodic model check, not daily calibration and ongoing hardware troubleshooting.
TOTAL ANNUAL O&M (per monitored unit)	\$58,000 – \$155,000	\$12,000 – \$30,000 + license fees	Net annual saving of \$28,000 – \$143,000+ per unit, depending on unit complexity and local costs.

Cost ranges reflect industry averages across natural gas-fired turbines, boilers, and engines. Actual costs vary by facility, unit count, analyzer complexity, and applicable regulations. PEMS license fees are provided separately in proposal and are not included in the figures above.

SECTION 2 — 10-YEAR TOTAL COST OF OWNERSHIP (Illustrative, 4-Unit Facility)

Cost Category	Traditional CEMS (10-Year Total)	Trace PEMS (10-Year Total)	Trace PEMS Saving
Initial capital cost (4-unit facility)	\$500,000 – \$900,000	\$240,000 – \$500,000	\$260,000 – \$400,000
Cumulative Operations & Maintenance (10 years, 4 units)	\$3,560,000 – \$10,240,000	\$480,000 – \$1,200,000 + license fees	\$2,800,000 – \$9,000,000+
Mid-life hardware replacement (yr 5–7)	\$80,000 – \$250,000	\$0	\$80,000 – \$250,000
10-YEAR TOTAL	\$3,820,000 – \$10,990,000	\$560,000 – \$1,400,000 + license fees	\$2,900,000 – \$9,500,000+

10-year TCO uses midpoint of annual ranges applied to 4 monitored units. CEMS figures include mid-life hardware replacement at years 5–7, consistent with 10–15 year CEMS lifecycle. PEMS license fees excluded (provided in proposal).

SECTION 3 — OPERATIONAL & COMPLIANCE BENEFITS

Factor	Traditional CEMS	Trace PEMS
Data availability	85–95% (hardware-limited; gaps during maintenance, RATA, failures, accuracy degradation with age)	~100% continuous (no hardware to go offline)
Data substitution events	Common during maintenance windows, RATA testing, unplanned failures	Essentially eliminated (continuous DCS-based reporting)
RATA testing burden	Multi-analyzer RATA per unit + stack flow monitor RATA. Scaffolding, specialist team.	Annual single-model validation. Reduced scope, no flow monitor RATA.
Staffing requirement	Dedicated CEMS technician or service contract required	Managed remotely; no dedicated on-site technician needed
Equipment footprint	Analyzer shelter, sample lines, probe, DAHS, calibration gas storage	Software-based; uses existing DCS instrumentation

SECTION 4 — REGULATORY ACCEPTANCE

Regulatory Pathway	PEMS Acceptance Basis
EPA	EPA Performance Specification 16
State Title V Permits	PEMS incorporated via permit amendment as approved alternative monitoring method.

Trace manages the full regulatory approval process including petition preparation, agency coordination, and ongoing compliance documentation.

Ready to evaluate PEMS for your facility?

Trace Environmental Systems provides a no-cost initial qualification assessment to determine whether your combustion units are candidates for PEMS substitution. We handle the regulatory approval process end-to-end.

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All regulatory citations current as of February 2026. This document is for informational purposes and does not constitute a binding offer. Site-specific analysis provided upon request.