

EXECUTIVE BRIEF · OPERATIONAL THERMODYNAMICS INTELLIGENCE

BEST DEMONSTRATED PERFORMANCE

Using A Plant's Own Operational History
As A Thermal Performance Reference Environment

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EXECUTIVE SUMMARY

The plant's own historian is its most relevant benchmark

Most thermal power plants have already operated at materially better thermal-performance conditions at some point within their own operational history.

In many cases:

- lower heat rate,
- lower fuel intensity,
- improved thermal stability,
- and superior operating efficiency

have already been demonstrated by the unit itself during prior operating periods.

However, over time, thermal performance often progressively deteriorates through operational drift.

Importantly, this deterioration may develop while the plant continues appearing operationally stable. Generation remains acceptable. Dispatch targets are met. Combustion remains within expected ranges.

Yet progressively more fuel becomes required to sustain equivalent electrical output.

This creates an important operational opportunity: using the plant's own historically superior operating states as a thermodynamic performance reference environment.

This concept is referred to as Best Demonstrated Performance (BDP).

TRADITIONAL BENCHMARKING LIMITATIONS

Historically, thermal plants often evaluate performance against:

- OEM design conditions,
- generic industry benchmarks,
- fleet averages,
- or theoretical efficiency expectations.

These references remain useful. However, they may not fully reflect:

- the unit's actual operating environment,
- fuel characteristics,
- equipment condition,

- site-specific constraints,
- or historically achievable operational performance.

Importantly, many plants have already demonstrated materially superior operating states within their own historical environments.

This creates a potentially more operationally relevant benchmark: the plant's own historically demonstrated thermal-performance envelope.

THE IMPORTANCE OF OPERATIONAL CONTEXT

Thermal performance is highly contextual.

Performance outcomes may vary due to:

- fuel quality,
- load conditions,
- ambient environment,
- equipment condition,
- operational strategy,
- thermal-state stability,
- and radiative transfer behaviour.

As a result, comparing current operation to generalized theoretical benchmarks may not always provide sufficient operational insight.

A plant's own historically superior operating periods may provide:

- operationally contextualized reference conditions,
- historically achievable performance states,
- and more realistic thermodynamic alignment targets.

THERMAL PERFORMANCE DRIFT

Thermal plants do not always lose performance suddenly. In many cases, performance deteriorates gradually through operational drift.

This may involve:

- increasing fuel intensity,
- deteriorating heat rate,
- thermal-state instability,
- and declining transfer effectiveness.

Importantly, the unit may continue operating within apparently acceptable operational ranges while this drift develops.

Historically, the challenge has often been not identifying that performance deteriorated — but understanding how far current operation has drifted from historically superior thermal-state conditions.

BEST DEMONSTRATED PERFORMANCE (BDP)

Best Demonstrated Performance refers to historically observed operating conditions where the unit demonstrated superior thermal-performance outcomes within its own operational environment.

This may include periods characterized by:

- lower heat rate,
- lower fuel intensity,
- improved thermal stability,
- superior fuel-to-steam conversion,
- and stronger thermal transfer effectiveness.

Importantly, BDP is not:

- a theoretical design target,
- an OEM guarantee,
- or an external benchmark.

It is historically demonstrated plant behaviour.

HISTORIAN-DERIVED THERMAL-STATE COMPARISON

Modern thermal plants already possess large operational historian environments containing:

- fuel flow,
- steam conditions,
- load behaviour,
- emissions,
- combustion conditions,
- and operational-state histories.

Historian-derived operational intelligence enables comparison between current operating conditions and historically superior operational states.

This may improve visibility into:

- operational drift magnitude,
- thermal-state evolution,
- fuel-intensity variation,

- and performance stability.

THE EMERGING OPERATIONAL PERSPECTIVE

Historically, thermal-performance management has focused heavily on:

- maintaining operational stability,
- satisfying dispatch,
- controlling combustion,
- and minimizing outages.

An emerging operational perspective suggests that thermal-performance management may increasingly involve understanding how closely current operation aligns with the plant's own historically superior thermodynamic operating states.

This includes improving interpretation of:

- thermal-state behaviour,
- thermal coupling effectiveness,
- operational drift development,
- and fuel-to-steam conversion stability.

DETERMINISTIC OPERATIONAL INTERPRETATION

Importantly, historical performance comparison must remain:

- operationally contextualized,
- traceable,
- deterministic,
- and engineering-reviewable.

The objective is not generic AI optimization.

The objective is historian-derived operational thermodynamics interpretation grounded in actual plant operating history.

AN OPERATIONAL INTELLIGENCE LAYER

At YBGGlobal.com, part of the current focus involves historian-derived reconstruction of thermal-state behaviour to identify:

- historically superior operating conditions,
- operational drift development,
- and thermal-performance alignment opportunities.

The objective is not replacing:

- plant operators,
- DCS systems,
- APC environments,
- or combustion controls.

The objective is improving visibility into how current thermal-state conditions compare to the plant's own best historically demonstrated operating behaviour.

CLOSING OBSERVATION

Most thermal plants have already demonstrated superior thermal-performance states within their own operational history.

The challenge is often not whether improved performance is possible. The challenge is understanding:

- how thermal-state conditions evolved,
- how operational drift developed,
- and how closely current operation aligns with historically superior thermodynamic performance environments.

This creates an emerging operational opportunity: using a plant's own operating history as a deterministic thermal-performance reference framework.