Empowering Combined Cycle Plants

Meeting Rising Power Demand with Reliable, Flexible, and Intelligent Combined Cycle Plants

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YOKOGAWA
Co-innovating tomorrow™

INTRODUCTION

NAVIGATING THE EVOLVING ENERGY LANDSCAPE

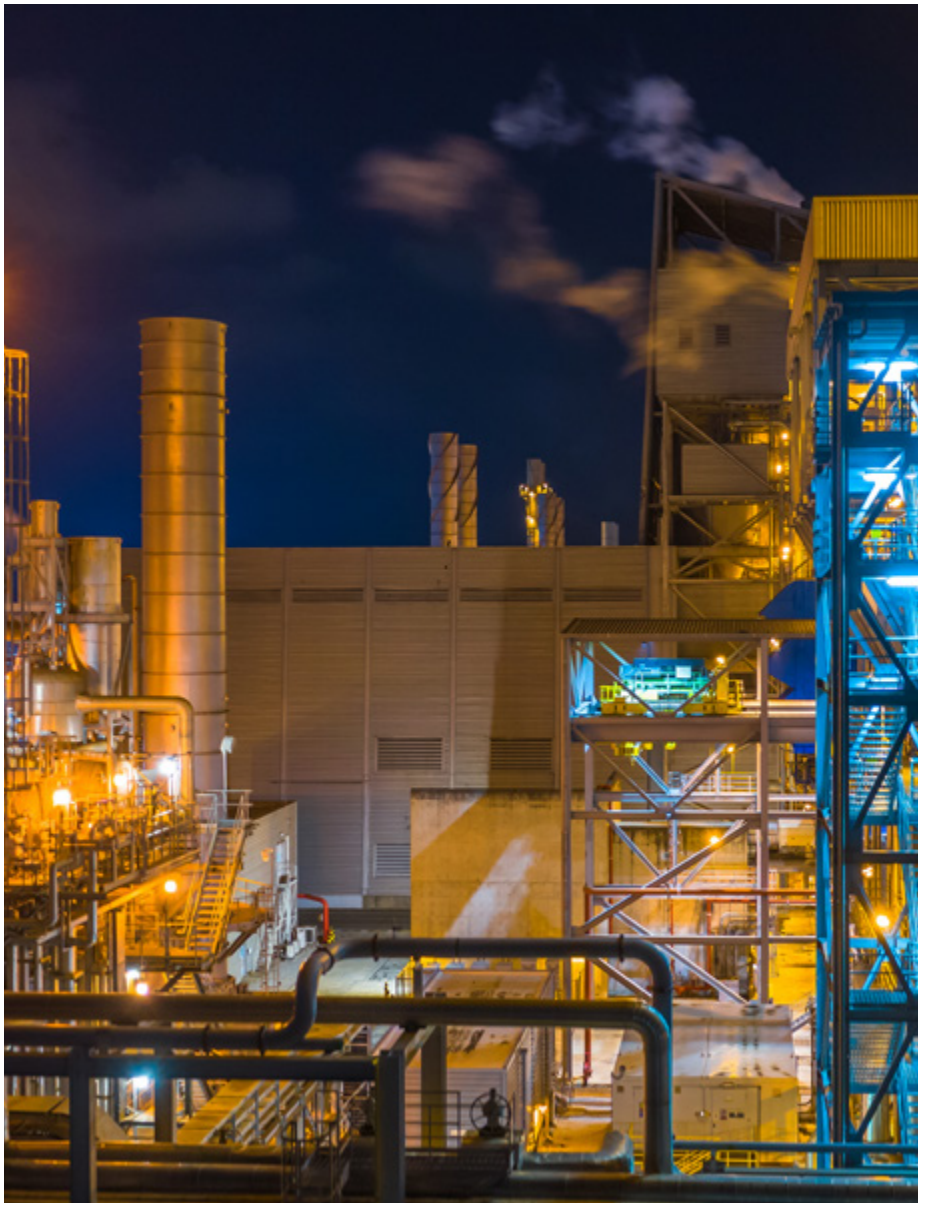
A Smarter Path to Flexible, Reliable, and Profitable Power

Maintaining efficiency, reliability, and availability in a combined cycle power plant is no longer just a performance goal—it's a survival strategy. In a world of rising operational costs, aging infrastructure, and increasingly dynamic grid demands, are you doing enough to optimize your output while protecting your bottom line?

In this eBook, we explore how digital control systems, advanced instrumentation, and integrated data platforms can help you boost flexibility, extend equipment life, and reduce unplanned downtime—without compromising on safety or compliance.

While this eBook focuses on combined cycle power generation and the key systems and technologies that impact plant efficiency in North America, many of the strategies and solutions described are equally applicable to power producers around the globe navigating similar market and operational pressures.

On behalf of the entire Yokogawa team, we hope this resource empowers you to rethink what's possible in your plant.

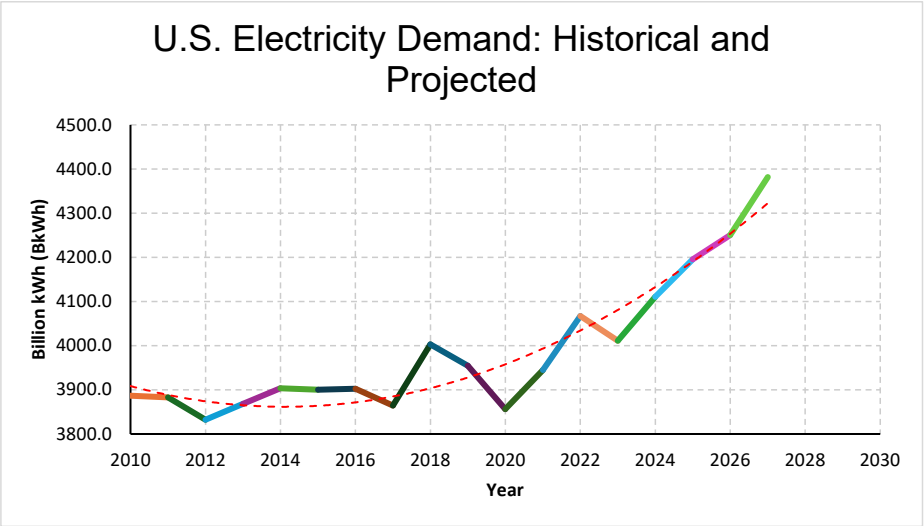


1 Critical Factors Impacting the Power Industry

Understanding the forces reshaping power generation.

Electricity demand is entering a new phase of growth driven by electrification, data center expansion, and evolving industrial energy needs. At the same time, power producers must operate within increasingly complex regulatory frameworks while maintaining reliable and affordable electricity for the grid.

Combined cycle power plants are uniquely positioned to help meet these demands. Their high efficiency, operational flexibility, and proven reliability make them essential assets in the modern energy mix. Understanding the broader forces shaping the industry is the first step toward identifying the technologies and strategies that allow plants to operate successfully in this changing environment.



U.S. Electricity Demand, 2010–2027

Metric: total electricity end use (retail sales + direct use), billion kWh (BkWh).

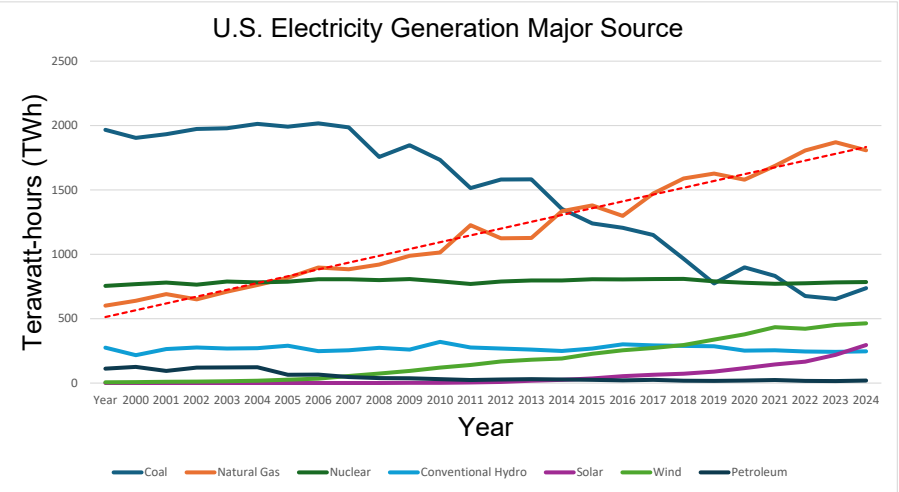
Year	Demand (BkWh)	Status	YoY change	Index (2010=100)
2010	3886.8	Historical		100.0
2011	3882.6	Historical	-0.1%	99.9
2012	3832.3	Historical	-1.3%	98.6
2013	3868.3	Historical	0.9%	99.5
2014	3903.3	Historical	0.9%	100.4
2015	3900.2	Historical	-0.1%	100.3
2016	3902.3	Historical	0.1%	100.4
2017	3864.3	Historical	-1.0%	99.4
2018	4003.1	Historical	3.6%	103.0
2019	3954.4	Historical	-1.2%	101.7
2020	3856.4	Historical	-2.5%	99.2
2021	3944.8	Historical	2.3%	101.5
2022	4066.9	Historical	3.1%	104.6
2023	4011.2	Historical	-1.4%	103.2
2024	4110.4	Historical	2.5%	105.8
2025	4195.1	Historical	2.1%	107.9
2026	4250.0	EIA STEO projection (approx.)	1.3%	109.3
2027	4381.8	EIA STEO projection (approx.; 3.1% growth from 2026)	3.1%	112.7

Sources: EIA Monthly Energy Review, Table 7.6, EIA Short-Term Energy Outlook, June 2026, EIA Annual Energy Outlook 2026, EIA Today in Energy, May 19, 2026
2026 Notes: Current EIA short-term forecast; rounded.
2027 Notes: Calculated from EIA's 3.1% projected growth rate.

Power Demand Is Changing—Fast

Electricity demand in North America is accelerating at a pace not seen in decades. Electrification of transportation, buildings, and industrial processes—combined with the explosive growth of data centers and AI—is placing unprecedented pressure on the grid. At the same time, new power infrastructure faces longer permitting timelines, higher costs, and evolving regulatory expectations.

CCPG plants are uniquely positioned to bridge this gap.
Their ability to deliver reliable, flexible, and efficient generation makes them a cornerstone of the modern energy mix. This eBook explores the critical factors shaping the future of power—and how smarter measurement, control, and lifecycle strategies can help operators meet rising demand with confidence.



ELECTRICITY DEMAND IS ACCELERATING

Electricity demand in North America is expected to grow significantly over the coming decades as transportation, heating, and industrial systems continue to electrify.

COMBINED CYCLE EFFICIENCY EXCEEDS 60%

Modern combined cycle power plants are among the most efficient fossil-based generation technologies ever built.

DATA CENTERS MAY DOUBLE POWER DEMAND

Large data centers supporting AI workloads can consume as much electricity as 100,000 homes.

2 Maximizing Generation Reliability and Uptime

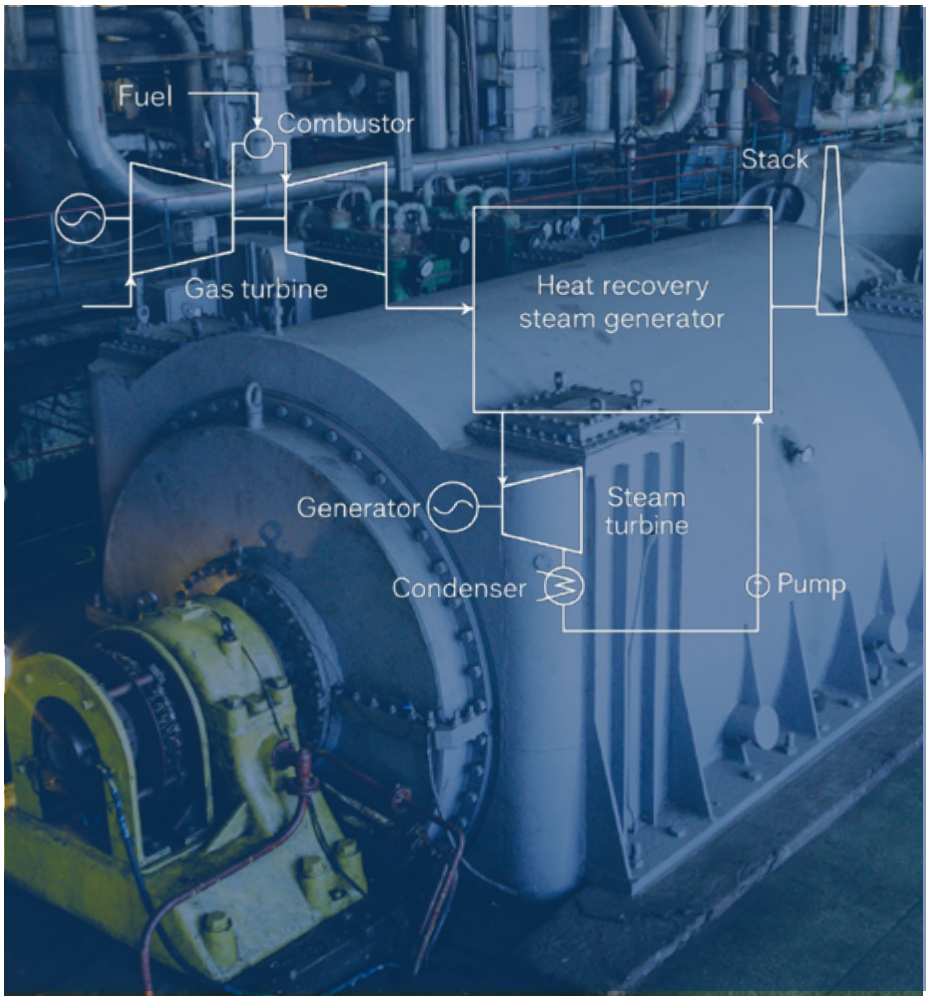
Maximizing Generation Reliability and Uptime

Keeping power generation stable in an increasingly dynamic grid

Reliable power generation depends on stable operations across every major system within the plant—from steam generation and water chemistry to instrumentation, alarms, and cybersecurity. Even small deviations in process conditions or system visibility can escalate into equipment stress, efficiency losses, or unplanned outages.

As combined cycle plants are asked to cycle more frequently and respond to changing grid demands, maintaining operational reliability becomes even more critical. Accurate measurements, robust control strategies, and strong operational visibility help operators detect issues early and maintain stable performance across the facility.

This chapter explores the technologies and operational practices that help plants maintain high availability, protect critical equipment, and minimize unplanned downtime.



UNPLANNED OUTAGES ARE COSTLY

Unplanned outages in large power plants can cost hundreds of thousands of dollars per day in lost generation and operational disruption.

2.1 CYBER SECURITY

Cybersecurity for combined cycle power plants demands a full, layered approach to protect Operational Technology (OT). This includes separating IT and OT networks with firewalls and perimeter or screened subnets (DMZs), using zero-trust access controls, continuously monitoring ICS/SCADA systems, and managing supply-chain risks in line with rules like NERC CIP (North American Electric Reliability Corporation Critical Infrastructure Protection). These features help block cyber threats, stop malware from spreading, and give operators real-time visibility into risks—keeping plants safe, compliant, and running smoothly.

As cyberattacks on OT systems increase and new ICS vulnerabilities are found every year, power plants need more than one-time fixes. Secure remote access, system hardening, asset monitoring, and 24/7 threat detection help prevent outages, improve safety, and speed up response when issues occur. The result is reliable power generation and fewer surprises. Yokogawa's consulting and solutions help put an OT-focused cybersecurity program in place—one that protects operations every day and turns cybersecurity into a reliable and trusted strength.

$500,000+ PER DAY

Unplanned outages in large power plants can cost hundreds of thousands of dollars per day in lost generation revenue.

THOUSANDS OF ALARMS PER DAY

Operators in complex facilities may receive thousands of alarms daily without proper alarm rationalization.

CYBERATTACKS ON ENERGY INFRASTRUCTURE ARE RISING

The energy sector remains one of the top three most targeted industries for cyberattacks worldwide.

2.2 STEAM DRUM LEVEL

In a steam drum level application, accurate measurement and responsive control are essential to protecting boilers and maintaining reliable power generation. Yokogawa's pressure transmitters provide precise, stable drum level measurements under the high-pressure, high-temperature conditions typical of power plants. When paired with the Single-loop single-loop controller, this accurate measurement foundation enables consistent and dependable control, reducing the risk of low-water conditions or water carryover that can damage equipment and lead to forced outages.

Yokogawa pressure transmitters are designed for long-term stability and resistance to vibration, thermal shock, and process noise, ensuring trustworthy data during start-ups, shutdowns, and rapid load changes. The Single-loop controller uses this high-quality input to execute proven PID control and support single-, two-, or three-element drum level control strategies. This combination allows the control system to respond quickly to changes in steam flow and feedwater demand, maintaining tight level control even during aggressive cycling and load swings.

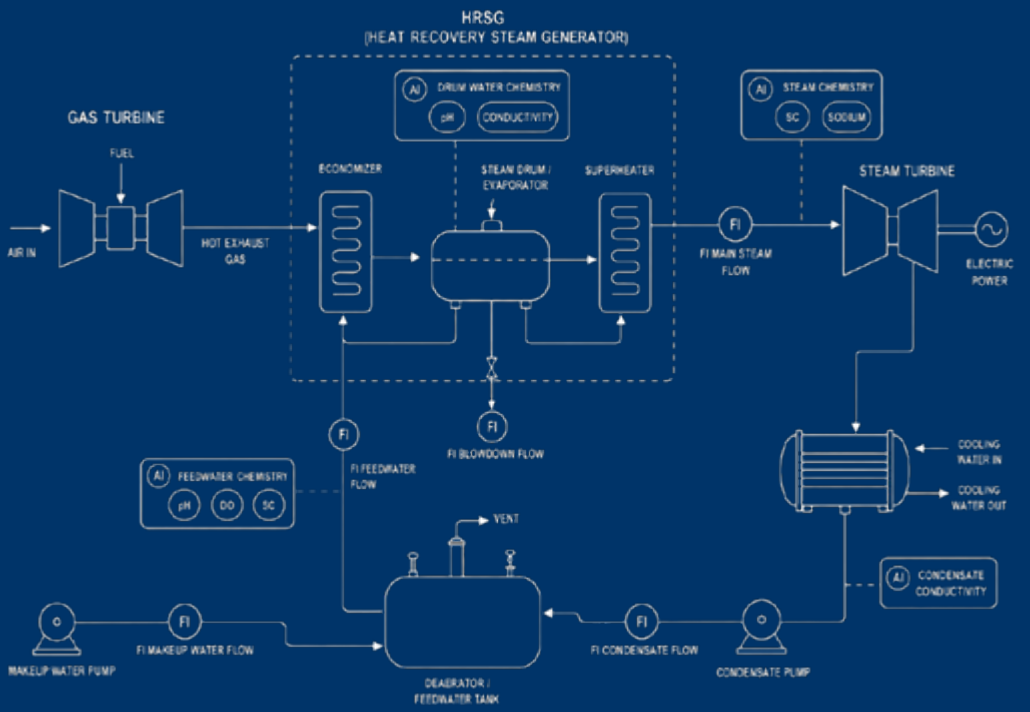
Together, Yokogawa's pressure transmitters and the single-loop controller help minimize process variability, reduce thermal stress on boiler components, and lower the likelihood of nuisance trips. Advanced diagnostics and intuitive operation simplify troubleshooting and tuning, reducing maintenance effort and downtime. The result is improved plant availability, extended equipment life, and maximized generation reliability and uptime—key performance drivers for today's power industry.

2.3 PROTECTING THE WATER-STEAM CYCLE

Maintain the Water Balance
Accurate measurement of condensate, makeup water, feedwater, blowdown, and steam flow helps account for water throughout the cycle.

Protect Critical Equipment
Monitoring pH, conductivity, dissolved oxygen, sodium, silica, and related chemistry parameters helps keep water and steam within safe limits. Poor chemistry can cause corrosion, scaling, carryover, turbine deposits, and reduced equipment life.

Accurate Measurements, Stable Operation
Accurate feedwater and steam flow improve drum-level control, load control, heat-balance calculations, and performance monitoring. Stable chemistry preserves heat-transfer surfaces and turbine efficiency, helping the plant sustain reliable output over time.



2.4 ALARM MANAGEMENT

In modern power plants, operators must monitor thousands of alarm points that signal abnormal conditions, equipment stress, or process deviations. When alarms are poorly managed, nuisance alarms and alarm flooding can overwhelm operators, leading to slower response times, missed critical events, and increased risk of unplanned outages. Yokogawa's Alarm Management Suite delivers a structured, standards-based approach to monitor, rationalize, and analyze alarms—reducing noise and elevating the conditions that truly require operator action. With tools like Exaquantum/Alarm Reporting and Analysis for alarm reporting and analysis and Exaquantum/Alarm Master Database for maintaining a master alarm database, plants can pinpoint nuisance alarms, refine setpoints, and keep their alarm strategy aligned with operational priorities.

This enhanced alarm strategy directly improves generation reliability and uptime. With fewer irrelevant alarms and clearer prioritization, operators can focus on true process anomalies quickly and confidently, reducing operator stress and decreasing the chances of human error. Historical alarm and event data collected in Yokogawa's alarm databases also enables root cause analysis and trend identification, supporting ongoing improvement in alarm configurations and operational decision-making. This continuous improvement cycle helps prevent recurring faults that might otherwise lead to equipment degradation or forced outages.

Systematically pinpoint recurring nuisance alarms, fine-tune setpoints, and keep the alarm system aligned with operational priorities—making issues easier to spot, manage, and correct.

KEY PERFORMANCE INDICATORS

ALARM STATES

3 Improving Efficiency and Reducing Cost

Improving Efficiency and Reducing Cost

Optimizing performance through precise measurement and control.

Efficiency remains one of the most important performance indicators for combined cycle power plants. Even small improvements in heat rate or energy utilization can translate into substantial fuel savings and improved overall plant economics.

Achieving these improvements requires accurate measurements and stable control across critical systems such as gas turbines, steam cycles, and balance-of-plant equipment. Reliable instrumentation and advanced automation technologies provide operators with the data and insight needed to maintain optimal operating conditions while minimizing losses.

This chapter highlights key measurement and control technologies that help plants operate more efficiently, reduce operating costs, and maximize the value of every unit of fuel consumed.

EFFICIENCY MATTERS

A 1% improvement in heat rate can translate into significant annual fuel savings for large power generation facilities.

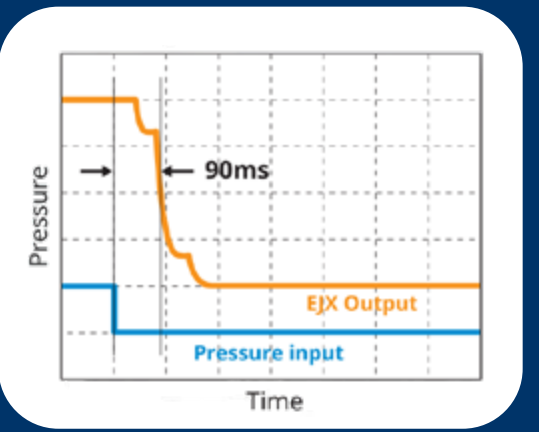
3.1 GAS TURBINE PRESSURE CONTROL

ACCURATE PRESSURE MEASUREMENTS ARE FUNDAMENTAL TO THE SAFE, STABLE, AND EFFICIENT OPERATION OF GAS TURBINES. SEVERAL KEY PRESSURE MEASUREMENT POINTS PROVIDE ESSENTIAL INPUTS TO TURBINE CONTROL SYSTEMS, PERFORMANCE MONITORING CALCULATIONS, AND CONDITION-BASED MAINTENANCE PROGRAMS. KEY MEASUREMENT POINTS INCLUDE THE COMPRESSOR INLET AND DISCHARGE PRESSURES, COMBUSTOR PRESSURE, EXHAUST BACK PRESSURE, AND THE FUEL GAS PRESSURE. THESE MEASUREMENTS ARE ESSENTIAL FOR TURBINE CONTROL LOGIC, EMISSIONS MANAGEMENT, AND PROTECTIVE INTERLOCKS.

1 | AIR FILTER DIFFERENTIAL PRESSURE

AAir filter differential pressure tells operators exactly how much restriction is building across the turbine inlet. As dust, salt, and contaminants load the filters, DP rises and airflow drops. Reduced airflow means lower compressor inlet pressure, which cuts gas turbine output and drags down HRSG steam production and steam turbine efficiency.

Yokogawa's DP transmitters give plants stable, long-term DP readings operators can trust. With 10+ years of proven stability and rugged field performance, they help trend filter loading, set reliable alarms, and prevent inlet restriction from stealing turbine performance.environments.



2 | COMPRESSOR INLET PRESSURE

The compressor inlet pressure serves as a reference point for the pressure ratio calculation and is a critical parameter in surge detection. In extreme cases low inlet pressure causes the gas turbine to surge or cause instability when airflow momentarily reverses direct causing large pressure oscillations and severe mechanical stress. The compressor inlet pressure measurement is critical for the anti-surge control algorithms to protect the turbine during load transitions and transient events. With Yokogawa's DPharp sensor technology response times of 90ms is essential for anti-surge control algorithms to react quickly to rapid inlet pressure changes during load transitions and other transient events. Combining the response time with high measurement accuracy, supports more reliable surge detection and tighter control margins to maintain compressor stability and operational uptime.

3.2 DP FLOW

True performance in DP Flow Measurement

Yokogawa's DP Flow solution, paired with a averaging pitot tube, provides combined cycle power plants with a highly accurate and reliable method for measuring steam and water flow in demanding turbine and heat recovery applications. The solid, one-piece design uses multiple sensing ports to average the velocity profile across the pipe, delivering a stable differential pressure signal even in high-temperature, high-pressure environments. This measurement stability helps operators optimize turbine output, maintain proper steam balance between turbines and HRSG systems, improve plant heat rate performance, and reduce operating costs. A key advantage of the Verabar is its extremely low permanent pressure drop — typically only about 3% of the measured differential pressure — preserving more usable steam energy compared to traditional orifice plates while also lowering auxiliary load and energy losses.

Yokogawa's multivariable transmitters—including the EJX910 Series with DPharp digital sensor technology—deliver highly accurate, simultaneous measurements of differential pressure, static pressure, and process temperature with exceptional long-term stability. Paired with an insertion-style design that minimizes pipe modifications and installation cost, the integrated solution supports seamless plant integration, improved efficiency, reduced energy losses, and lower lifecycle costs across steam and water applications.

Engineered for high-resolution, reliable data, these transmitters provide the measurement quality needed for accurate flow and energy calculations.

	MULTIVARIABLE (Averaging Pitot)	ORIFICE PLATE/ DIFF. PRESSURE
Permanent Pressure Loss	Up to 3% of Differential	Up to 70% of Differential
Accuracy	+/- 1.0%	+/- 2.0%
Required Straight Run of Pipe	Upstream and Downstream Required	Significant Upstream and Downstream Required
Turndown	10 : 1	3 : 1
Gas	Good	Good
Liquid	Good	Good
Steam	Good	Good

3.3 CENTUM & TURBOMACHINERY CONTROL

The Distributed Control System that Delivers Unmatched Reliability.

Many process plants operate with a patchwork of automation systems built over time, including the main DCS, OEM compressor PLCs, third-party controllers, separate HMIs, gateways, protocols, and vendor-specific tools. This fragmented approach increases engineering effort, integration risk, and long-term support costs.

By embedding advanced turbomachinery control algorithms inside Yokogawa CENTUM VP, compressor-control functions can operate within the same distributed control environment as the rest of the plant, using the same tools, interface, and data environment as the rest of the plant.
The complete system is tested across compressors, steam turbines, motors, auxiliary equipment, and process-control functions to support dependable operation, consistent lifecycle support, and easier long-term optimization.

This eliminates the need for separate compressor controllers, gateways, and custom interfaces. The result is a simpler architecture with less testing and integration effort, faster troubleshooting, reduced spare-parts complexity, and a more unified lifecycle strategy.

The key advantage is clear: compressor control remains highly specialized, but it no longer requires a fragmented automation architecture—delivering the same level of protection and performance with lower complexity and cost.

Integrated Controls
Compressor control remains specialized, but the automation architecture does not need to remain fragmented

4 Ensure Environmental and Regulatory Compliance

Environmental & Regulatory Compliance

Meeting evolving environmental expectations with confidence.

Environmental compliance remains a central responsibility for power producers. Regulations governing emissions, water usage, and environmental reporting continue to evolve, requiring plants to maintain accurate measurement systems and transparent data reporting.

For combined cycle plants, maintaining compliance depends on reliable emissions monitoring, high-quality process measurements, and data systems capable of supporting accurate reporting and audit readiness. Operators must not only meet current regulatory expectations but also remain prepared for changes in reporting requirements and environmental policies.

This chapter explores how advanced monitoring technologies and reliable measurement systems help plants maintain compliance while supporting safe, responsible power generation.

CONTINUOUS MONITORING

Emissions monitoring systems operate 24 hours a day, 365 days a year to provide accurate data for environmental reporting and regulatory compliance.

4.1 REGULATIONS & BURDEN OF REPORTING

Combined cycle power plants have to follow rules that are always changing. Even though the details of these rules may shift over time, plants are still expected to provide accurate data that can be checked and audited.

Plants must show they are meeting requirements for the environment, water use, and reliability, even as political priorities change. Getting permits adds another layer of difficulty. Environmental and water permits often take a long time to approve or update, and any delay can slow down plant operations or future expansion plans. No matter how regulations change, reporting is a constant responsibility. Plants must collect high-quality data for emissions, water use, permit limits, and grid reliability.

Even when official rules are postponed, plants are still expected to keep strong, defensible records. These records help them respond quickly to audits, reviews, and any sudden changes in regulations.

4.2 CEMS (CONTINUOUS EMISSIONS MONITORING SYSTEM)

Reliable and cost effective CEMS are available to measure a wide range of components. Depending on the site requirements, the CEMS can measure, NOX, SO2, CO2, CO, CH4, HCl or O2 in the sample gas.

Yokogawa's Continuous Emissions Monitoring Systems (CEMS) help plant operators stay confidently on top of environmental compliance while improving day-to-day visibility and emissions performance. Yokogawa offers proven analyzer technologies and end-to-end support from system design and installation to commissioning and ongoing reliable service.

Yokogawa makes it easier to maintain reliable, audit-ready data and reduce the burden of reporting. By delivering consistent measurements and clear insights, Yokogawa CEMS solutions enable customers to respond quickly to changing operating conditions and minimize compliance risk.

24/7 EMISSIONS DATA

Continuous emissions monitoring systems operate 24 hours a day, 365 days a year to ensure regulatory compliance.

ENVIRONMENTAL REPORTING IS EXPANDING

Environmental reporting requirements are increasing across air emissions, water usage, and grid reliability.

5 Optimize Asset Lifecycle and Maintenance Costs

Optimizing Asset Lifecycle and Maintenance Costs

Protecting critical equipment and extending plant life.

Combined cycle power plants represent long-term infrastructure investments designed to operate for decades. Maintaining the reliability and performance of these assets requires careful monitoring of process conditions, equipment health, and water chemistry throughout the plant lifecycle.

Small process issues—such as contamination in high-purity water systems or undetected equipment degradation—can lead to long-term damage if not identified early. Accurate analytical measurements and predictive maintenance strategies help operators detect these issues before they escalate into costly repairs or equipment failures.

This chapter examines technologies and operational practices that help plants protect critical assets, reduce maintenance costs, and extend equipment life.

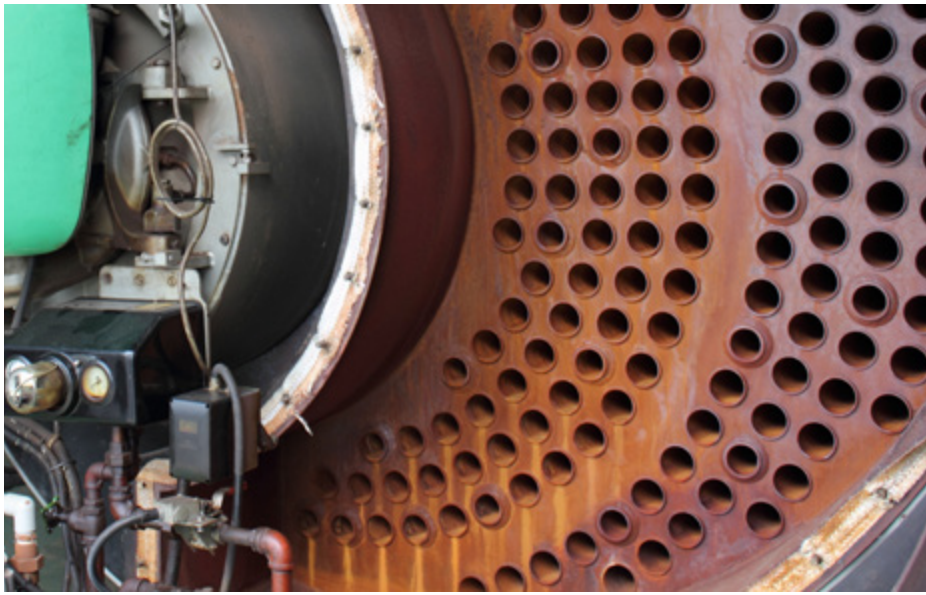
TRACE CONTAMINATION CAN DAMAGE EQUIPMENT

Even small amounts of contamination in high-purity water systems can contribute to corrosion, scaling, and long-term equipment damage.

5.1 WATER QUALITY

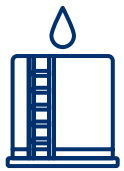
Accurate pH and conductivity measurements in high-purity water systems is critical for operations who rely on consistent water quality to protect assets, maintain efficiency, and meet strict process requirements. In applications such as boiler feedwater, pH is one of the earliest and most reliable indicators of contamination. Even small deviations can signal issues such as ineffective chemical treatment or the ingress of contaminants. Common impurities include dissolved salts like sodium and sulfates, dissolved gases like oxygen and carbon dioxide, and other organics. These contaminants lead to scaling which reduces heat transfer efficiency and accelerates corrosion in the steam system and turbine. Measuring pH in pure water presents unique challenges that conventional pH sensors often struggle to overcome. These water systems have extremely low ion content and with a very low conductivity value. Often leading to reference junction instability, slower response, and unstable readings in traditional pH sensors.

Yokogawa's FU24 pH sensor is designed specifically to address common challenges with making pH measurements in ultra-pure water. The FU24 is designed with a patented "bellomatic" reference electrode design that maintains constant, positive pressure of reference electrolyte. The constant pressure ensures steady flow and prevents dilution/depletion of the electrolyte solutions, common problems that occur in ultra-pure water. The result is dependable, high-accuracy pH measurements throughout the critical water treatment and steam cycle processes. By delivering stable, trustworthy pH data where traditional pH sensors fall short allows operators to protect equipment, optimize chemical treatment, extend asset life, and operate with greater confidence.



CONTAMINATION, MASSIVE DAMAGE

Even trace levels of contamination in high-purity water can cause corrosion or scaling inside boilers and turbines

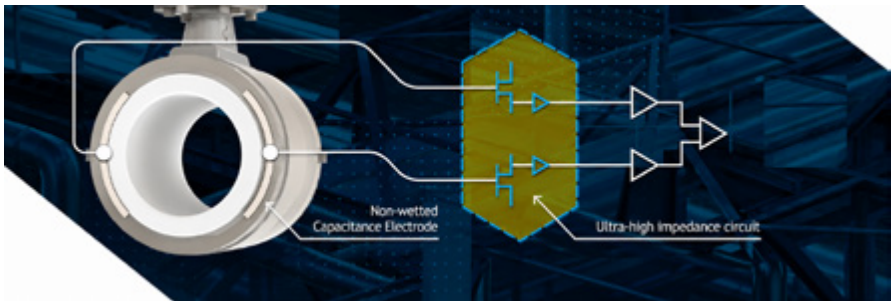


WATER CHEMISTRY PROTECTS MILLION-DOLLAR EQUIPMENT

Improper chemistry control can reduce the life of boilers, HRSGs, and turbines.

5.2 STABLE & ACCURATE MEASUREMENT

In combined cycle power plants, accurate flow measurement is critical for maintaining reliable operation across cooling water, condensate return, and wastewater systems. Yokogawa magnetic flowmeters provide highly reliable measurement of conductive liquids with virtually no pressure loss and minimal maintenance due to their non-intrusive design. Using electromagnetic induction, these instruments deliver stable, fast-response measurements even under fluctuating process conditions, helping operators maintain tighter control of critical water management systems that support efficient turbine and heat recovery operations. The Yokogawa CA Series Magnetic Flowmeter is specifically engineered for challenging applications, using non-wetted electrodes and a high-purity ceramic measuring tube to provide stable measurement of slurry fluids, adhesive liquids, and ultra-low-conductivity fluids such as purified water.



Yokogawa magmeters also feature dual frequency excitation technology, combining high-frequency response for rapidly changing flow conditions with low-frequency stability for noisy industrial environments. This advanced signal processing improves measurement reliability in pipelines affected by vibration, bubbles, or electrical interference commonly found in power plant water systems. In addition, Yokogawa's Total Insight concept integrates built-in diagnostics, verification tools, intuitive configuration, and HART communication support to simplify commissioning, improve operational visibility, and reduce maintenance effort. Together, these capabilities help combined cycle power plants improve reliability, maintain accurate flow control, and lower overall lifecycle costs.

Scan this QR code to explore the benefits or using Magnetic Flowmeters.

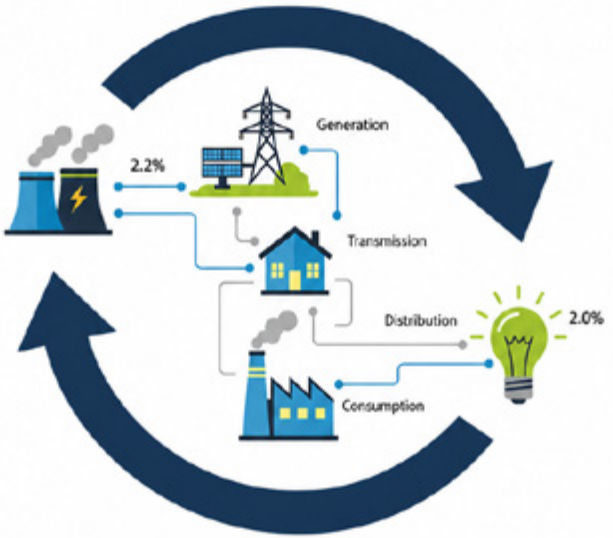
https://tinyurl.com/y6d9cp2k

5.3 ASSET PERFORMANCE MANAGEMENT

Real-Time Insights. Real-Time Benefits.

Your plant can't fix what it can't see. Asset Performance Management (APM) turns your equipment into a source of real-time insight. It uses sensors, data, and analytics to track how every asset is running—so you can spot problems early and act fast before they turn into failures. Stop reacting. Start predicting. With APM, you reduce downtime, cut maintenance costs, and make smarter decisions across your entire plant. It connects everything in one place, so your team can focus on what matters most—safe, reliable, and profitable operations.

APM becomes a force multiplier for efficiency and resiliency. By continuously monitoring HRSGs, gas turbines, steam turbines, and balance of plant equipment, APM identifies performance degradation long before it impacts heat rate, startup reliability, or grid responsiveness. Operators gain early warnings, automated diagnostics, and clear recommendations—helping the plant maintain stable output even under fluctuating loads, cycling conditions, or fuel variability. The result is a CCP operation that runs cleaner, steadier, and more profitably.



6 Reducing Risk and Maximizing Value Through Project Execution

Reducing Risk and Maximizing Value Through Project Execution

Delivering complex power projects with confidence.

Constructing or modernizing a combined cycle power plant requires careful coordination across engineering teams, equipment suppliers, and automation systems. Without a well-defined integration strategy, projects can face delays, cost overruns, and operational challenges that persist long after commissioning.

Successful plants rely on standardized instrumentation, integrated automation platforms, and clearly defined responsibilities across project partners. By aligning these elements early in the project lifecycle, plant owners and EPC contractors can reduce complexity and improve long-term operational performance.

This chapter explores how integrated project execution models—including Main Instrument Vendor and Main Automation Contractor strategies—help simplify implementation while creating a strong operational foundation for reliable plant performance.

PROJECT DELAYS ARE EXPENSIVE

Large energy infrastructure projects can lose millions of dollars in potential generation revenue when commissioning delays occur.

6.1 MIV (MAIN INSTRUMENT VENDOR)

Simplifying instrumentation across the entire project lifecycle.

Managing instrumentation across a large power project often requires coordinating multiple suppliers, specifications, and delivery schedules. This fragmented approach can increase project complexity, create integration challenges, and introduce unnecessary risk.

By engaging Yokogawa as the Main Instrument Vendor (MIV), project teams gain a single partner responsible for managing the full scope of field instrumentation—from engineering and procurement through installation support and lifecycle services. This approach standardizes instrumentation selection, simplifies vendor coordination, and helps ensure consistent measurement performance across the plant.

FEED › Integrated Engineering › Instrumentation Solutions › Project Site Services › Operational Site Services › **OPERATION & TRAINING**

Working closely with EPC contractors and plant owners, Yokogawa supports instrumentation strategy during early engineering phases, coordinates suppliers, and manages documentation and delivery schedules to help projects stay aligned with performance and timeline objectives.

The result is reduced project risk, improved execution efficiency, and a consistent instrumentation strategy that supports reliable plant operation over the long term.

01 Reduce CAPEX

Long-term scope, streamlined procurement, and flixible suppliers

02 Standardization

Simpliefed inventory, easier setup, and less training

03 Minimize Risk

Accelerated design with early MIV engagement, streamlined tendering, and MIV-managed scheduling

Scan this QR code to explore more about our MIV capabilities.

https://tinyurl.com/mw6s72fe

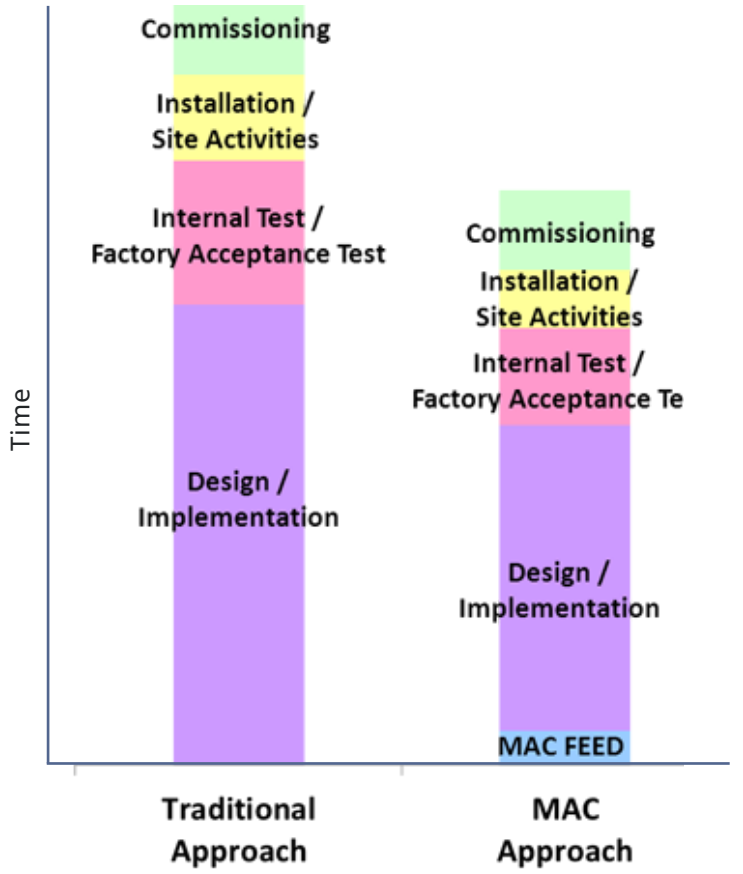
6.2 MAC (MAIN AUTOMATION CONTRACTOR)

Delivering automation systems with a single point of responsibility.

Automation systems sit at the core of modern combined cycle power plants, connecting control systems, safety systems, instrumentation, and critical plant equipment. Managing these systems across multiple suppliers can create coordination challenges and increase integration risk during project execution. As a Main Automation Contractor (MAC), Yokogawa assumes responsibility for the design, engineering, and delivery of the plant's automation architecture—providing a single point of accountability for control and integration.

Yokogawa coordinates control systems, safety systems, instrumentation interfaces, and third-party vendor packages to ensure consistent standards and seamless communication between systems. This integrated approach simplifies project management, reduces integration complexity, and helps accelerate commissioning timelines.

Supported by global engineering expertise and decades of automation experience in the power industry, Yokogawa helps ensure automation systems are delivered efficiently and positioned to support stable plant operations from day one.

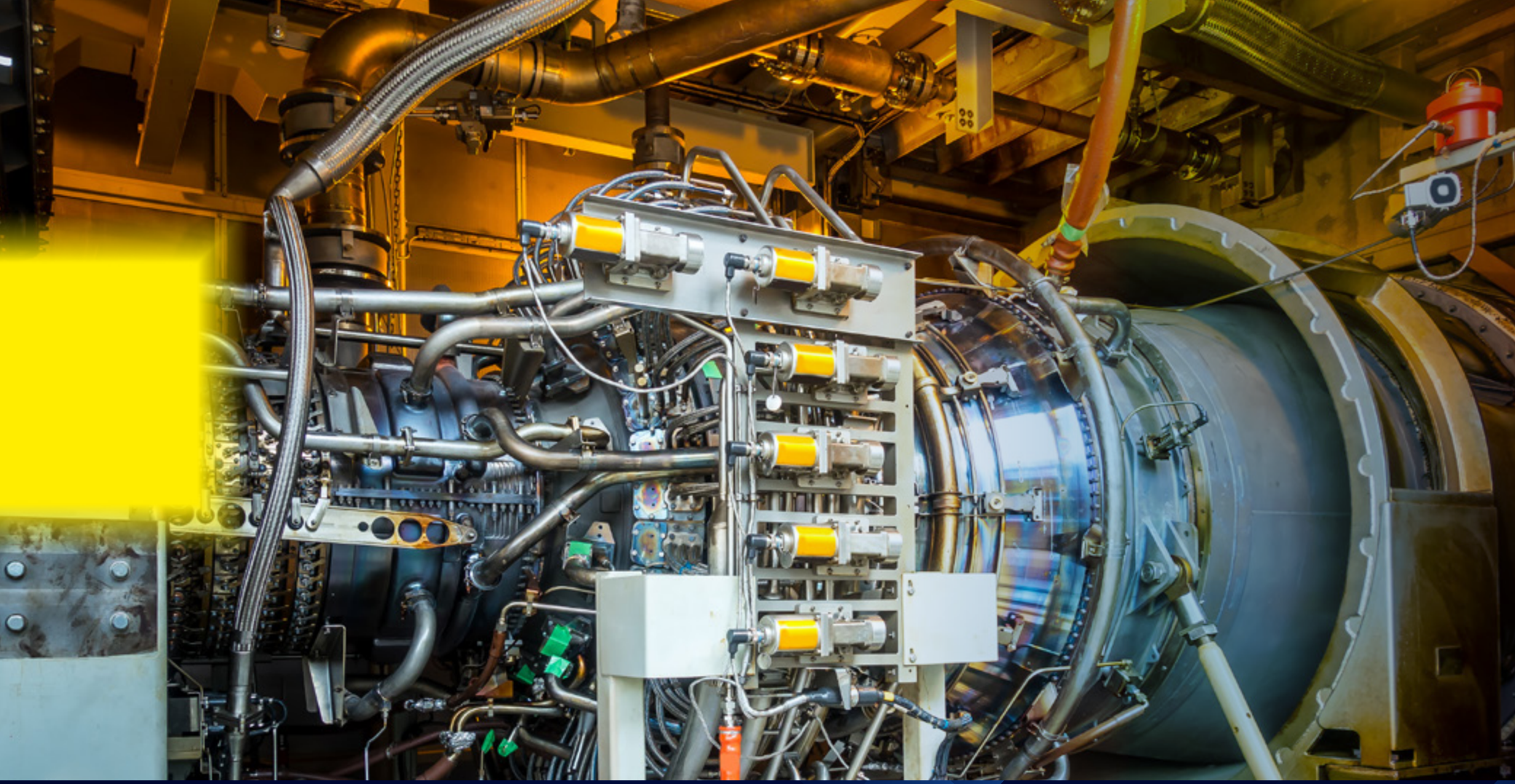


6.3 CENTUM & THE FUTURE OF AUTONOMOUS CONTROL

Advancing automation toward more autonomous plant operations.

CENTUM VP R7 gives operators deeper process insight and more adaptive control as plants face tougher operating conditions and faster-moving grids. Its advanced reinforcement-learning engine, FKDPP, continuously analyzes process behavior, detects early deviations, and automatically adjusts control outputs to keep operations stable. Routine actions are handled autonomously, reducing operator workload while maintaining predictable performance, and the Operator Support System strengthens situational awareness with forward-looking guidance during any circumstantial abnormal events.

With enhanced OPC UA connectivity and modernized engineering tools, CENTUM VP R7 integrates easily across plant systems and simplifies configuration throughout the lifecycle. Together, these capabilities create a resilient automation platform that minimizes operational surprises, supports steadier production, and frees plant teams to focus on higher-value work that drives long-term performance.



Real-World Applications of Yokogawa Solutions

Case Studies

OPTIMIZING DISSOLVED OXYGEN CONTROL FOR A COMBINED CYCLE POWER PLANT (CCPP)

The Operational Challenge

Operators at the facility depended on dissolved oxygen measurements to prevent corrosion within the steam generating system. Historically, the plant's existing measurement approach using traditional electrochemical sensors displayed frequent and significant drift over relatively short operating intervals demanding manual calibration, increased maintenance effort, and higher operating costs.

Selecting New Measurement Technology

After a routine instrumentation service visit, plant engineers were introduced to an alternative dissolved oxygen technology based on chemical luminescence. This alternative technology delivered:

- Long-term stability with minimal drift at low ppb measurement levels
- Eliminates the need for electrolyte or membrane replacement
- Reduced maintenance costs with longer calibration intervals

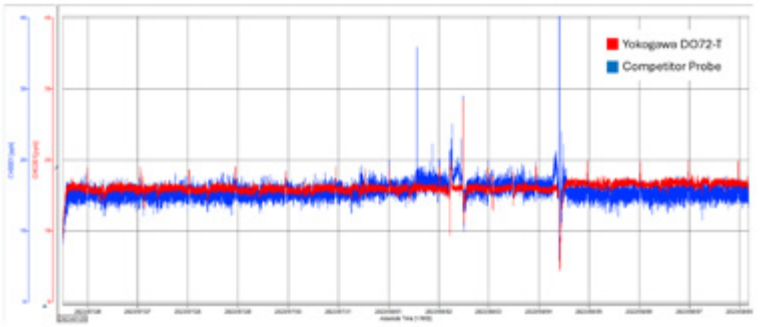


Figure 1. O2 setpoint at 15 ppb.

OPERATIONAL WINS THAT MOVE THE NEEDLE

01 Reliable data, no more guesswork: Operators reported consistent, high-integrity oxygen data with no appreciable drift

02 Tighter process control: Deaerator performance can be more tightly controlled, oxygen scavenger dosing can be optimized, and DO excursions are detected sooner

03 Reduced maintenance burden: Scheduled and corrective maintenance tied to oxygen measurement devices dropped significantly, freeing maintenance teams for higher-value tasks.

04 Enhanced confidence: The plant's engineering and operations teams gained confidence that they were making decisions based on accurate, actionable data allowing for better long-term asset protection decisions.

COMBINED CYCLE POWER PLANT PROJECT SUCCESS

Yokogawa's experience spans many combined cycle power plant projects, where we have partnered closely with EPCs and Customers to understand their goals, address operational challenges, and deliver solutions that produce measurable improvements. Across these engagements, our team has combined technical expertise with collaborative problem-solving to help streamline workflows, improve plant performance, and support long-term operational success.

TYPICAL PROJECT SCOPE

- Instrumentation selection, standardization, and supply coordination
- Pressure, temperature, flow, level, and analytical solutions
- Integration of third-party instruments, accessories, and enclosures
- Documentation and project coordination from feed to finish

LARGE SCALE PROJECT EXPERIENCE

- Yokogawa's experience spans many large-scale industrial projects, including combined cycle power plants and other large complex capital projects with thousands of instrument tags
- A key example includes a multiple mega projects with 5,000+ instrument tags, covering a broad range of field and analytical instrumentation including pressure transmitters, temperature transmitters, temperature elements, manifolds, seals, and 3rd party enclosures

CCPG SUCCESS

01 Across these engagements, Yokogawa has partnered closely with customers, EPCs, and operations teams

02 Understanding project goals, address execution challenges, and deliver solutions that support measurable improvements.

03 The scale and complexity of this project required strong coordination across engineering, procurement, documentation, and project management teams

04 Ensure all tag requirements were captured, quoted, documented, and delivered, Real-time scope adjustments and flexibility, minimizing and preventing schedule impacts

Supporting Operations from Commissioning to Continuous Optimization

Support Services

STARTUP AND COMMISSIONING

All Efficiency Boxes Checked.

If you start wrong, you stay wrong. Startup and commissioning make sure your analyzer systems are installed, tested, and running the right way from day one. Every wire, connection, and signal is checked so your system performs exactly as designed.

Get it right the first time. With expert technicians guiding the process, you avoid delays, protect your warranty, and set a strong performance baseline. That means faster startup, fewer surprises, and a smoother path to full production.

Proper startup and commissioning directly influence long term efficiency and resiliency. When analyzers feeding HRSGs, gas turbines, steam turbines, and emissions systems are calibrated and validated from day one, operators gain accurate data they can trust. That accuracy drives better combustion control, cleaner heat rate performance, and more stable operation during cycling and load changes. A strong commissioning process ensures your plant isn't just online—it's optimized for reliability, compliance, and sustained profitability.

INSTRUMENTATION & ANALYTICAL SOLUTIONS TRAINING

Your System is Only as Strong as Your People.

Yokogawa offers training focused on instrumentation and analytical solutions to help teams build the knowledge needed to operate, maintain, and optimize critical plant systems. Through hands-on instruction and application-based learning, participants gain a stronger understanding of measurement technologies, analytical equipment, calibration practices, troubleshooting methods, and system integration. This training supports safer operations, improved reliability, faster issue resolution, and more consistent performance.

Instrumentation Training Classes

- Magnetic Flowmeters
- Pressure Transmitters
- Vortex Flowmeters
- Temperature Transmitters
- Coriolis Mass Flowmeters

Analytical Solutions Training Classes

- Tunable Diode Laster Spectrometer Essentials
- Gas Chromatography Essentials
- Process Analyzer Sample Conditioning System Essentials
- Gas Density Training
- Zirconia Oxygen Analyzer Training
- Liquid Analytical Training

SERVICE & SUPPORT

The Support You Need, When You Need It.

When something breaks, time matters. Service & Support gives you fast access to experts who can fix issues, restore performance, and keep your plant running. From calibration to repair to troubleshooting, you get help when and where you need it.

Don’t wait for failure—stay ahead of it. With ongoing support and maintenance, you reduce unplanned downtime and keep your equipment working at peak performance. It’s not just fixing problems—it’s preventing them before they start.

Responsive service and proactive support are essential to maintaining efficiency and resiliency. When HRSGs, gas turbines, steam turbines, and critical analyzers are backed by experts who understand CCP dynamics, issues are resolved faster and root causes are eliminated before they cascade into heat rate losses or forced outages. Continuous support ensures tighter emissions control, more stable cycling performance, and greater reliability during peak demand. The result is a plant that stays online, stays efficient, and stays profitable.


GLOBAL REACH &
LOCAL EXPERTISE
YOKOGAWA SHOWS UP WHERE YOUR OPERATIONS ARE — WITH THE PEOPLE, SUPPORT, AND INSIGHTS TO SET YOUR PLANT ON A COURSE FOR A RESILIENT AND RELIABLE FUTURE
YOKOGAWA
Co-innovating tomorrow™

About Yokogawa

Our Offices

Yokogawa Offices

Newnan, GA
- Manufacturing
- Product management
- Customer service & support
- Training

Baton Rouge, LA
- Technology Service Center
- Training

Scarborough, ME
- Yokogawa Fluid Imaging Technologies

Wayne, PA
- Technology Service Center
- Training

Salt Lake City, UT
- Technology Service Center
- Training

Plano, TX
- U.S. Technology Center

Coldspring, TX
- Analytical engineering, design & construction

Sugar Land, TX
- Corporate headquarters
- Yokogawa Fluence Analytics
- Automation engineering services & support
- Control systems design, sales & support
- Training

Calgary, AB Canada
- Sales, Engineering & Service Operations

Mexico City, Mexico
- Sales, Engineering

Yokogawa Business Reps

Yokogawa supports customers through a North America–wide network of specialized representatives, providing local expertise and personalizedsupport.

USA
- Brea, CA
- Lakeland, FL
- Hebron, KY
- Baton Rouge, LA
- Plymouth, MA
- Frontenac, MO
- Farmington, NY
- Media, PA
- Deer Park, TX
- Kirkland, WA

Canada
- Edmonton, AB
- Brossard, QC

Mexico
Guatemala
Belize
El Salvador
Honduras
Nicaragua
Costa Rica
Panama

OTHER PUBLICATIONS

COMBINED CYCLE POWER PLANT SOLUTIONS BROCHURE

Explore Yokogawa's integrated solutions for combined cycle power plants, including instrumentation, control systems, analyzers, and digital technologies designed to improve reliability, efficiency, and operational visibility across the entire power generation process.

Download NOW

MAIN INSTRUMENT VENDOR (MIV) PROGRAM OVERVIEW

Learn how Yokogawa's Main Instrument Vendor approach simplifies project execution by standardizing instrumentation, reducing integration complexity, and improving commissioning efficiency for new power plant projects.

Download NOW

ENVIRONMENTAL MEASUREMENT SOLUTIONS BROCHURE

Understand how Yokogawa's Environmental Monitoring Systems deliver accurate, audit-ready emissions data to help power plants maintain environmental compliance while improving operational transparency.

Download NOW

PRODUCT & SOLUTIONS BROCHURE

Yokogawa addresses customer issues regarding increasingly complex production, operations management, and the optimization of assets, energy, and the supply chain with digitally enabled smart manufacturing, enabling the transition to autonomous operations.

THANK YOU!

We appreciate you taking the time to explore this eBook on improving the performance of combined cycle power plants.

As the power industry continues to evolve, operators face increasing demands for reliability, efficiency, flexibility, and regulatory compliance. Yokogawa remains committed to helping power producers navigate these challenges through advanced measurement technologies, intelligent automation systems, and comprehensive lifecycle services.

If you would like to learn more about the solutions discussed in this eBook—or explore how Yokogawa can support your plant's operational goals—our experts are ready to help.

To continue the conversation, please visit our website or connect with your local Yokogawa representative.

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