



Refining Solutions

Achieving Operational Excellence
in a Dynamic Market

Operational Excellence

How can Yokogawa help you achieve long-term business success?

Yokogawa has brought true innovations to industry. We are committed to ensuring accuracy, reliability, and safety for production systems throughout the plant life cycle. Our comprehensive solutions and expertise enable customers to achieve improved results with reduced total costs of ownership.

As companies all over the world strive for a competitive advantage, they must stay ahead by pursuing measures that to increase efficiency, optimize plant processes, and improve product quality.

Yokogawa delivers field-proven technologies that endure difficult conditions and allow plants to maximize performance, profitability, and, most importantly, safety.

Achieve higher quality data while solving operational challenges tied to safety, efficiency, reliability and optimization by investing in quality instrumentation and sensors to considerably reduce maintenance and provide a rapid return-on-investment (ROI), improved TCO, and reliability in your refinery.

Plant Availability

Business Agility & Flexibility

01 High Availability Systems



One of the most fundamental and often overlooked factors for maximizing revenue is the reliability and maintainability of automation systems. Utmost system availability is a key requisite for refinery uptime.



Long-term business success needs a long-term strategy. A long-term partnership with Yokogawa will help provide the highest total value of ownership for automation solutions.

04 Lifetime Partnership

Deep Expertise

03

Lifetime Partnership

04

Profitability

Safety

Long-Term
Business
Success

Enterprise-wide Automation 02

Yokogawa is an automation supplier with an extensive hands-on understanding of the usage of information for each layer of a refinery operation. Yokogawa is a premier supplier of integrated plant-wide automation solutions that deliver agility and flexibility to refinery workflow.



As refiners strive for further productivity improvements and a tighter commitment to HSE, they are adopting new practices. Yokogawa's 100+ year of automation know-how can help refineries achieve efficient operations under increasing constraints.



Deep Expertise 03

Maximize productivity, safety, and uptime



Reliability is in our DNA

Highly reliable automation systems maximize plant availability

One of the most fundamental and often overlooked factors for maximizing revenue is the reliability and maintainability of automation systems. Utmost system availability is a key requisite for refinery uptime.

Reliability of the production control system

All automation suppliers take system reliability – a key factor for refinery availability – seriously. However, none matches Yokogawa in its extreme commitment. At the heart of all of the company's systems is the unique "Pair and Spare" controller architecture, consisting of a redundant set of CPU modules that, in turn, each contains two microprocessors.

The two microprocessors constantly compare each other's outputs, initiating a bumpless switchover if any mismatch is detected. The actual availability track record of the Yokogawa CENTUM VP DCS reaches 99.99999% (seven 9s).

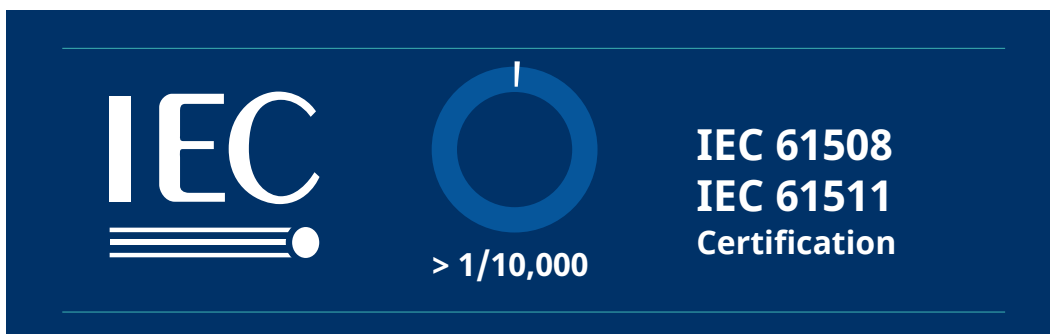


Reliability of the safety instrumented system (SIS)



Yokogawa's ProSafe-RS is the world's first, truly integrated safety instrumented system. Its integrated architecture with the production control system enables unified monitoring and an operation environment for the operator. ProSafe-RS has been 3rd party certified to be compliant to both IEC 61508 and IEC 61511 process safety standards. Additionally, it has been approved for use in Safety Integrity Level 3 (SIL 3)* applications, such as Emergency Shutdown (ESD), Fire

and Gas (F&G) and Burner Management Systems (BMS). The IEC 61508 and ISA/IEC 61511 certification attests to the high level of Yokogawa's technology and the quality of its safety instrumented systems.



*1 To be certified for SIL3, safety systems must be tested by a third party for a risk factor that measures less than 1/10,000.



“Yokogawa’s DCS has provided excellent service since start-up, with no refinery downtime being attributable to control system problems.”

**-Shell Refining Australia Pty. Ltd.
Geelong Refinery**

A large industrial refinery complex is shown at night, illuminated by numerous bright lights. The facility features several tall distillation columns, a network of pipes, and storage tanks. The lights create a strong blue and white glow against the dark sky. In the foreground, there are silhouettes of trees and a body of water that reflects the lights from the refinery.

Yokogawa’s DCS has established industry-leading availability

Predictive maintenance using digital technologies

Digital Instrumentation

Yokogawa's asset management solution deploys total predictive maintenance through proactive and preventative techniques for improving reliability and production efficiency in equipment and process failures, transition losses, and idle time. This initiative makes plant asset conditions predictable and performance sustainable, allowing scheduled plant maintenance before a failure occurs and only when necessary, greatly reducing unnecessary inspection and improving productivity.

Condition Based Maintenance Enhances Uptime

Monitoring and maintaining diverse equipment in the field is an essential part of day-to-day plant operation. Yokogawa's line of Sushi Sensors offers field-proven technologies capable of handling the toughest conditions or application challenges. Sushi Sensor solutions enable plants to automate manual operator rounds, providing improved, real-time visibility of equipment health conditions across the entire facility.



Fast, Simple and Strong

- Installation – M6 screws or magnetic type
- LoRaWAN® protocol ensures connectivity to whole plant, up to 10 mile range
- Pressure, temperature, and vibration monitoring



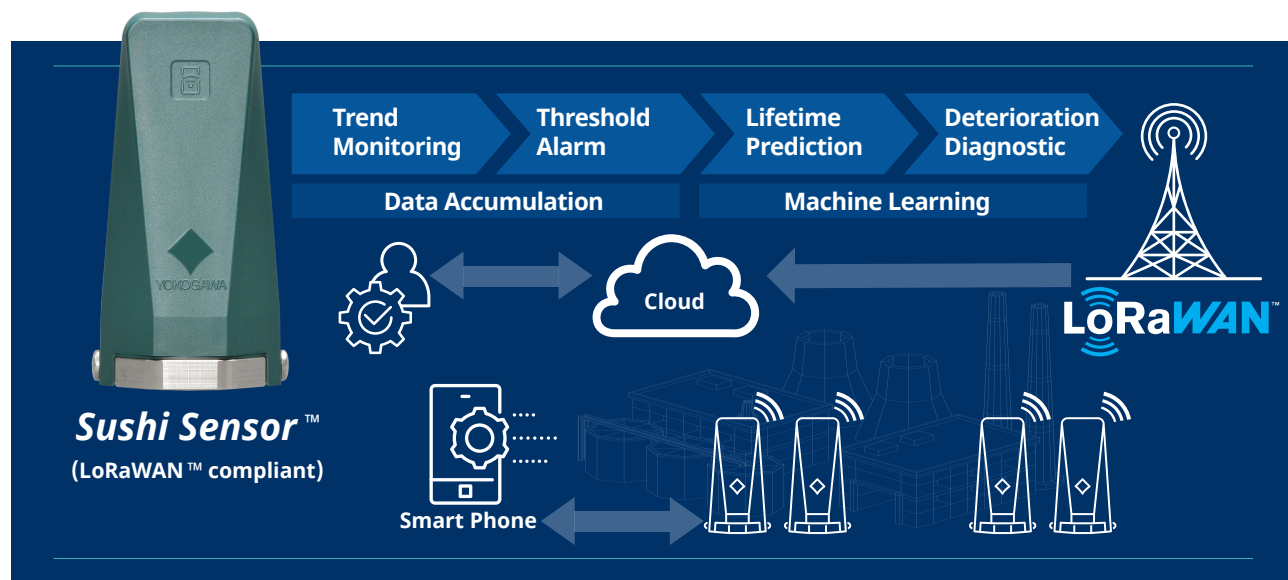
Condition Based Maintenance

- Improve equipment monitoring without additional labor
- Eliminate errors in operator observation/methods
- Inspection data is digitized and ready for analysis
- Anomalies/ abnormality in data trends are available



Advanced Anomaly Detection with AI

- Monitor and learn healthy operating conditions
- Data can be analyzed on premise or in the cloud
- Detect anomalies and alert staff to abnormal operating conditions very early
- Prioritize inspection and maintenance before failures occur





FieldMate™
(for Field Technicians)

InsightSuite™ AE

PRM™ Plant Resource Manager

Plant
Management

Maintenance
Engineers

Operators



Process Unit

Condition
Monitoring



Instruments &
Valves

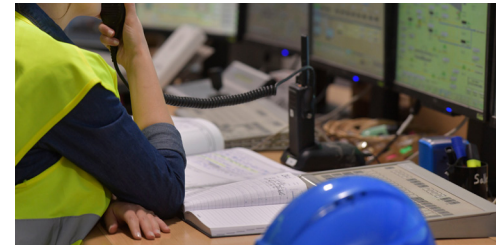


Asset excellence systems, the digital future is here

Enhance agility

Agile systems navigate the energy transition and the 'new normal' business ecosystem

Yokogawa is an automation supplier with an extensive hands-on understanding of the usage of information throughout a refinery. As a premier supplier of integrated automations solutions, Yokogawa delivers agility and flexibility to the refinery workflow.



■ Industry Control Systems

Distributed control systems provide the industry's highest field-proven system availability, enterprise-wide interoperability, extensive advanced solutions portfolio, and third-party-certified defense-in-depth cybersecurity to increase productivity and improve plant operations.

■ Analytical Systems

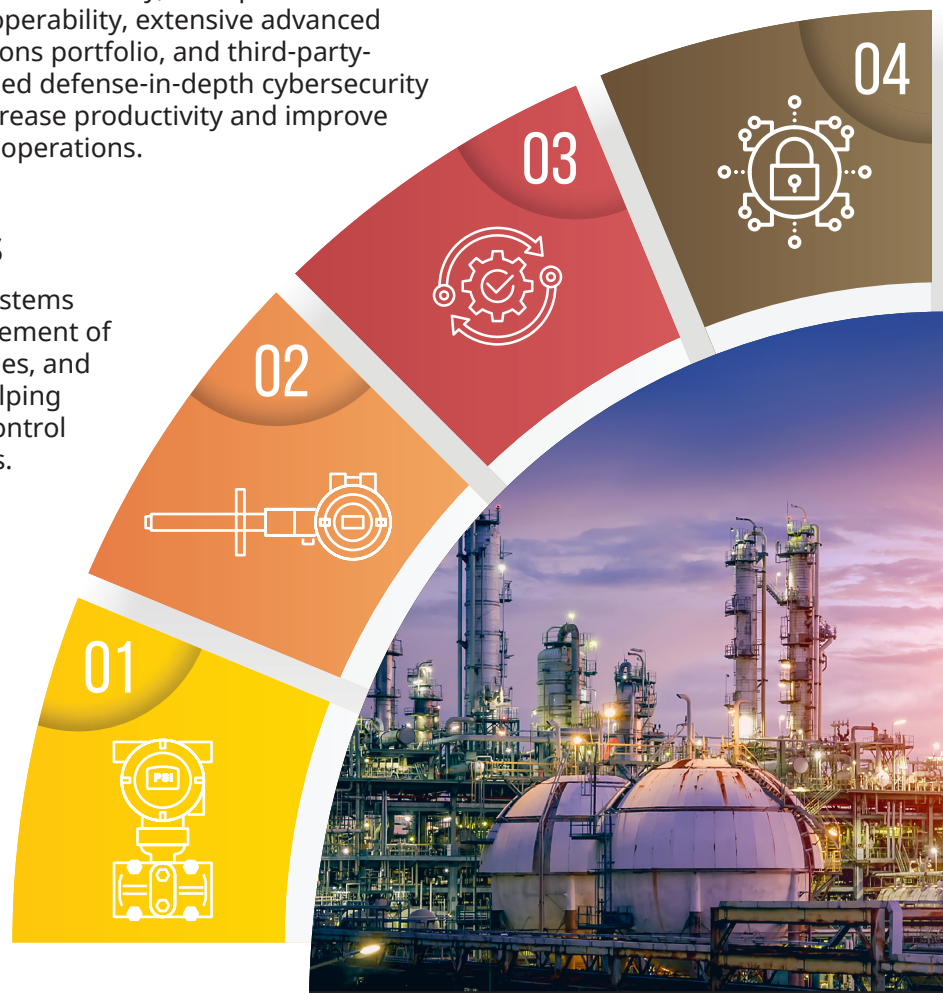
Highly responsive analytical systems contribute to accurate measurement of product, intermediate properties, and boiler/furnace combustion, helping refiners meet tighter quality control and environmental regulations.

■ Sensing Solutions

Measurement technologies enable the realization of innovative solutions to achieve high quality and safety in production. These superior measurement technologies deliver enhanced value throughout the refinery lifecycle.

■ Safety Management

Safety instrumented systems (SIS) deliver high availability without compromising superior safety performance. Yokogawa offers safety solutions to meet multiple safety integrity level requirements for a range of process safety applications.





Solutions for the entire enterprise

■ Advanced Process Control

An advanced process control (APC) platform brings together multi-variable control, quality estimation, complex calculations, and user interface definitions, creating a unique all-in-one application, that dramatically reduces deployment time and simplifies maintenance, for robust performance.

■ Smart Industry Readiness

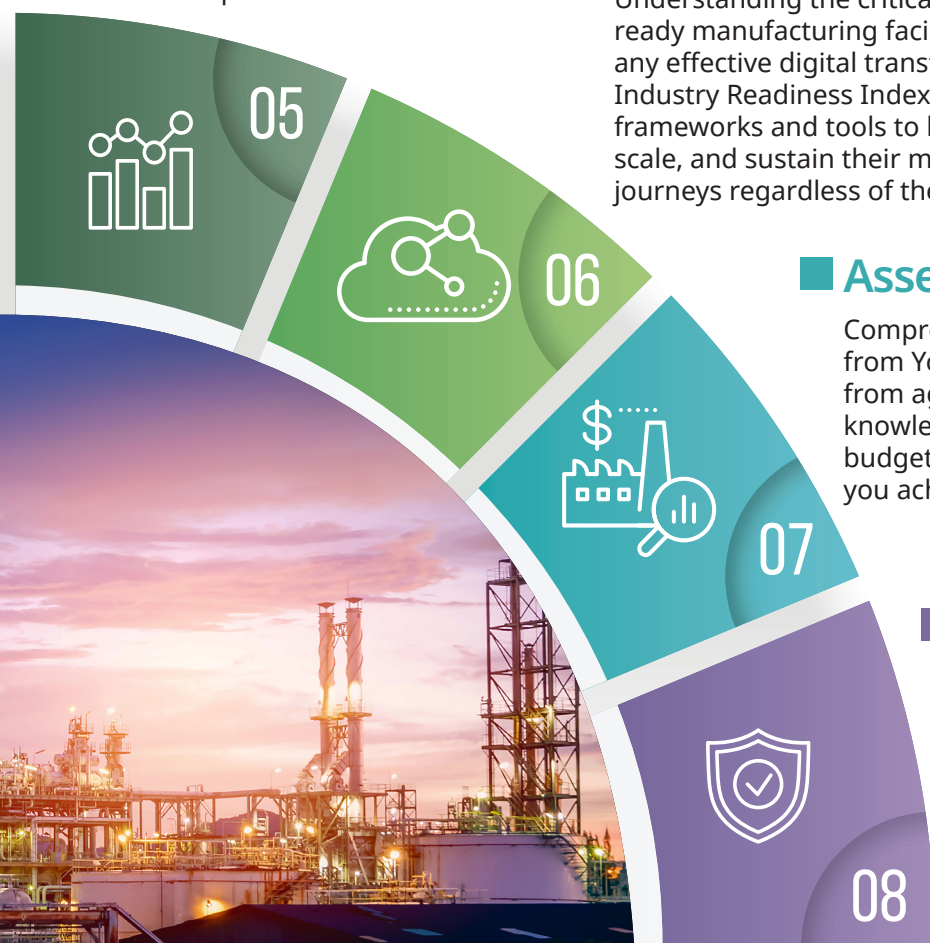
Understanding the critical components of a future-ready manufacturing facility is a critical first step in any effective digital transformation journey. The Smart Industry Readiness Index (SIRI) comprises a suite of frameworks and tools to help manufacturers start, scale, and sustain their manufacturing transformation journeys regardless of their size and industry.

■ Asset Management

Comprehensive asset management solutions from Yokogawa look at common challenges from aging assets and loss in maintenance knowledge/capability to reduced maintenance budget and increasing asset complexity to help you achieve the greatest return.

■ Cybersecurity Management

Yokogawa focuses on delivering long-term lifecycle services to minimize risk, maximize business success, and achieve sustainable long-term, secure operations.



Operational Excellence

Extensive application expertise increases profitability, and improves health, safety and environmental compliance

As refiners strive for further productivity improvements and a tighter commitment to HSE issues, they are adopting best practices. Yokogawa's extensive refining application know-how enables refineries to adopt best practices to operate efficiently under increasingly challenging constraint.

- 01 Control room consolidation
- 02 Plant-wide integrated control and optimization
- 03 Tank content analysis
- 04 Safe, stable operation with a lean workforce
- 05 Maximum utilization
- 06 Optimum procurement
- 07 Tank inventory monitoring
- 08 Path selection and monitoring
- 09 Blending control
- 10 Automation and knowledge based operation
- 11 Lower sulfur diesel production
- 12 Continuous emissions monitoring
- 13 Flue gas NOx reduction

07 08
Storage



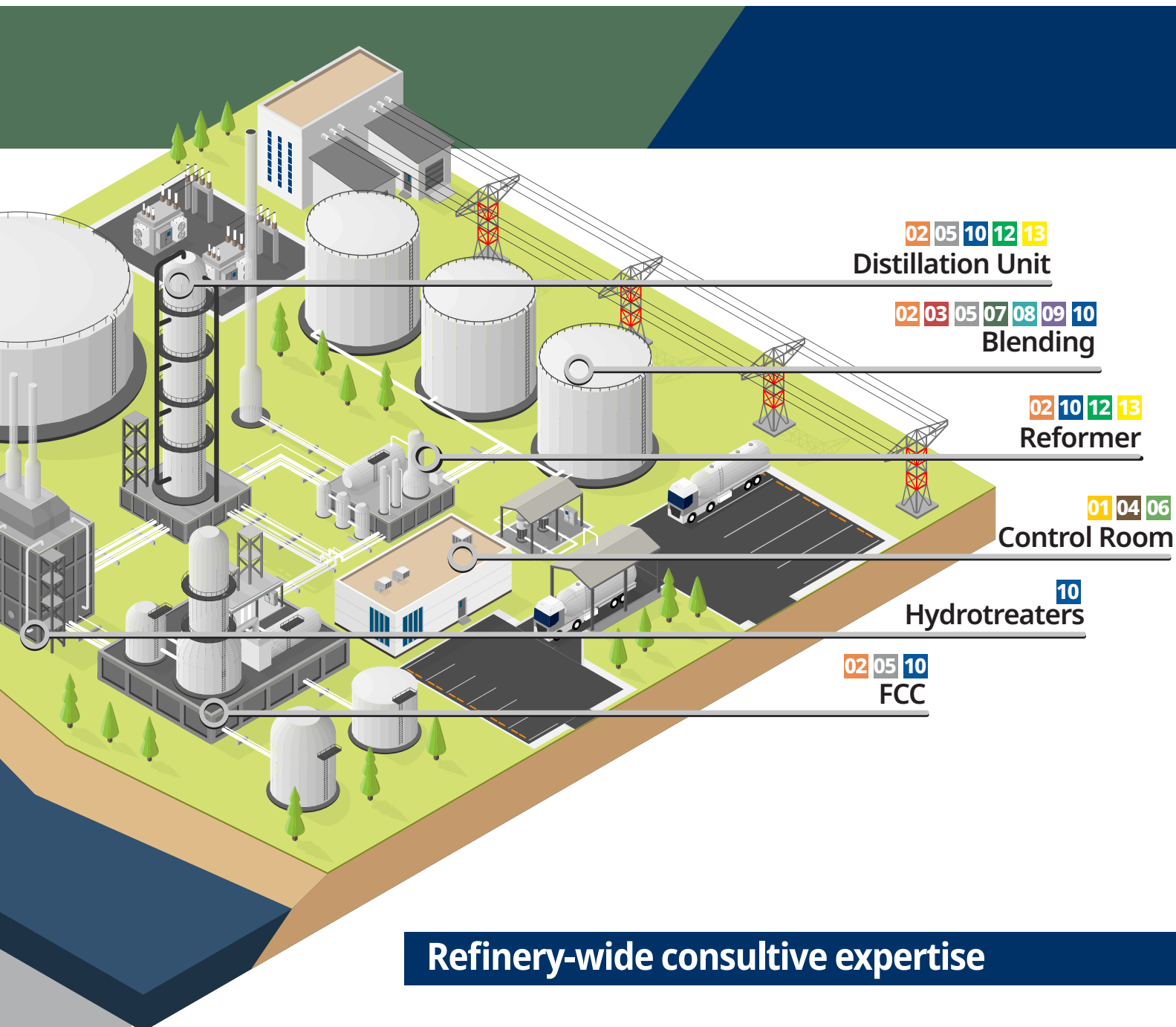
01 Control room consolidation

Yokogawa's production management center solution consolidates all control rooms over the entire refinery. Facilitating production process restructuring of operation and planning functions, it enables a learner workforce to oversee the entire plant more effectively.

02 Plant-wide integrated control and optimization

Best practices in operational efficiency have led to a set of new production and operation concepts that are becoming a cornerstone for productivity and profitability. Yokogawa provides the latest in new advanced control and operation technologies, such as:

- Multi-unit and onsite/remote operation
- Plant-wide optimization
- Predictive optimization control by online feed quality estimation
- Feedback from offsite tank quality to onsite process unit operating targets
- Plant-wide energy control system for minimizing energy usage such as reducing flaring and steam loss



Refinery-wide consultive expertise



03 Tank content analysis

Tank property estimation enables prompt oil transfer from an intermediate tank to blending or shipping facilities without laboratory testing. It exemplifies Yokogawa application knowledge enabling continuous production through the latest mechanisms of quality assurance.

04 Safe, stable operation with a lean crew operating staff

Leveraging extensive hands-on experience of helping refineries to run a safe and stable operation with a lean workforce, Yokogawa provides the following services:

- Stability evaluation service using standardized indices calculated from alarm and manipulation analyses
- Operation load evaluation service using standardized indices
- Root cause analysis of instability problems and proposal/delivery of appropriate solutions, including control system improvements, APC implementation, operator load reduction by operation environment reengineering, and knowledge-based assistance systems.

Achieve Plant Efficiency



05 Maximum utilization

Advanced process and blending control solutions enable refineries to maximize utilization of heavier and sour crude. Yokogawa solutions include FCC maximum residue oil blend charge control and blending ratio maximization in the fuel oil blending control.

06 Optimum procurement

Yokogawa provides a production information structure and environment that focus on rapid and flexible scheduling as well as high-accuracy planning. Such improvements enable agile supply chain management and optimum procurement of heavier and sour sources.



Monitoring Solutions

07 Tank inventory monitoring

The tank inventory monitoring solution keeps track of tank operation levels and batch conditions.

08 Path selection and monitoring

The path selection and monitoring solution helps operators carry out path selection faster and easier, preventing product contamination. It enables energy-efficient pump selection and prevents errors by minimizing the gap in operator skills and experience.

09 Blending control

Yokogawa provides a full analyzer integration solution that combines NIR analysis with blend control. Blending property control enables accurate blend ratio control, reducing quality giveaway and off-spec product by monitoring on-stream analyzers.



TOTAL

“ There are few people in the world who understand and provide solutions for remote-automation. The best of them are with Yokogawa. ”

-Total Antwerp Refinery

Knowledge Management

10 Automation and navigation of knowledge based operation

Knowledge-intensive operations such as plant startup/shutdown, compressor start-ups or crude switchover still require manual handling by a large number of operators, providing an opportunity for further operational efficiency improvement. The retirement of experienced operators is becoming a real and impending threat in terms of the loss of operations know-how such that operational knowledge management is becoming a critical issue in today's refineries. Yokogawa's knowledge based automation system leverages the knowledge of experienced operators and gives operators operational instruction online in sequence.

Health, Safety and Environmental Compliance

11 Lower sulfur diesel production

Demand for low sulfur diesel (LSD) is increasing world-wide. Measurement of low sulfur content is a key factor for successful operation in hydro de-sulfurization processes. Yokogawa offers online measurement for low sulfur using process gas chromatography.

12 Continuous emissions monitoring

The continuous emission monitoring system for utility boilers and furnaces monitors CO, CO₂, NO_x, SO₂, CH₄, and O₂ concentration in the flue gas using an infrared gas analyzer, helping refineries comply with environmental regulations.



“Yokogawa's knowledge-based automation system succeeded in reducing operator's workload dramatically during plant start-up and shutdown. Operators can easily incorporate their operation know-how in the system. Operation know-how can be standardized and shared among the operators”

-Nippon Shokubai Co., Ltd.
Kawasaki Plant



13 Flue gas NO_x reduction

The combustion control system optimizes utility boilers and furnaces, integrating a Zirconia oxygen analyzer that measures the oxygen concentration in the flue gas. It enables reductions in various oxides (e.g. NO_x, SO₂) in the flue gas while improving fuel economy.

From 'Sensing' to 'Sensemaking'

Combining reliable technology with superior field knowledge, Yokogawa's Total Insight optimizes operations and reduces maintenance costs through every phase of the product lifecycle.

Long-term business success needs a long-term strategy. A long-term partnership with Yokogawa will help provide the highest total value of ownership for automation solutions.



Expert Solution
Utility and Maintenance



Simplified Selection
Engineering and Procurement



Smart Assist
Installation and Commissioning



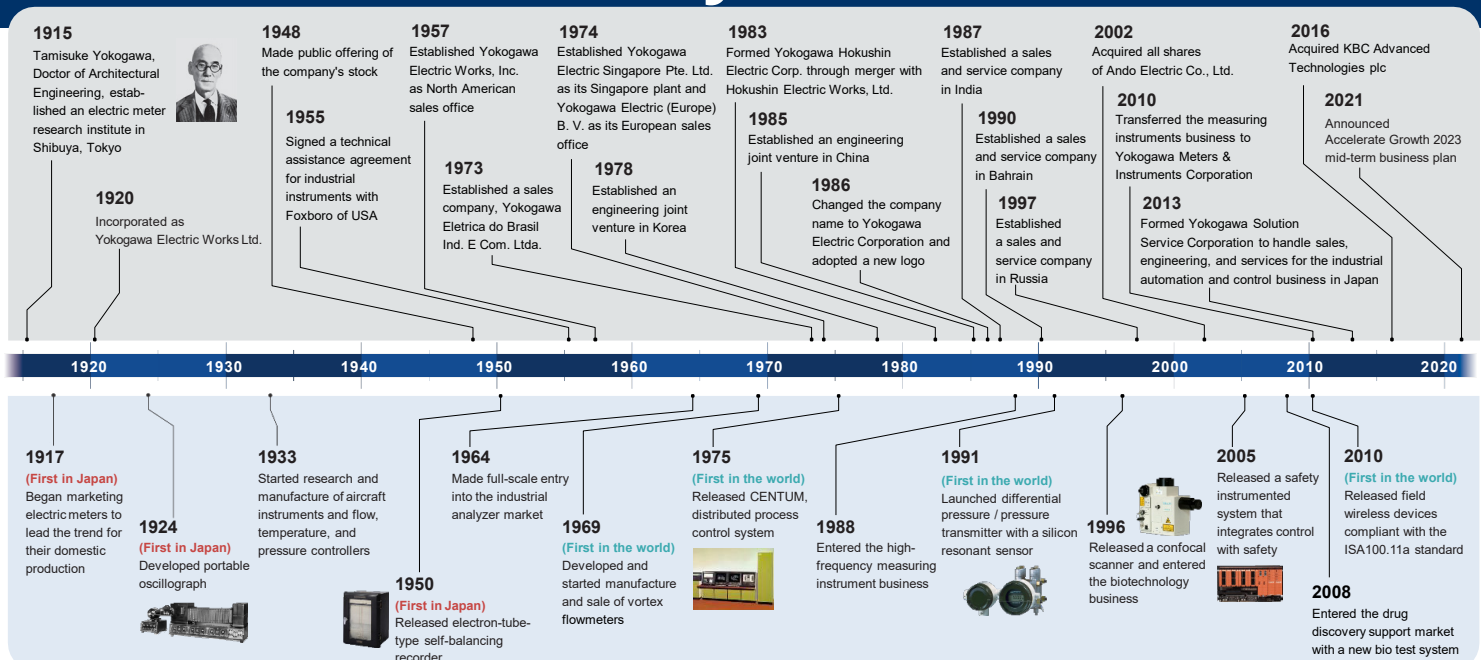
Process Guard
Operation and Observation

Measurement instrumentation began its digital journey many years ago. As smart instrumentation evolved, it added asset management functionality and provided insight into the process. Today, smart instrumentation must integrate seamlessly into a digitally transformed enterprise. The Total Insight portfolio from Yokogawa is a major step change in technology over smart instrumentation and enables digital transformation, leading to:

- Enhanced profitability
- Improved reliability
- Improved safety
- Extended asset performance
- Reduced asset failure
- Higher return on investment
- Vastly improved productivity

Over 100 Year History

88 Affiliates in 56 countries



Three decades of compatibility

A lifetime partnership maximizes the total lifecycle value

Consistency and long-term support are the hallmarks of Yokogawa's production control systems. From the very first CENTUM system introduced in 1975 to the latest CENTUM VP system, Yokogawa's standard practice ensures seamless technology.



Three ways Yokogawa is planning for the future

- 01** Yokogawa's Open Process Automation (OPA) Test Bed Collaboration Center will be used to evaluate candidate components and standards which will provide the basis for moving OPA technology into initial industrial field trials. A goal to enable more open and modular systems that support integration of best-in-class components, will reduce system capital costs and total cost of ownership.
- 02** To help customers keep pace with rapid advances in technology and an ever-changing business environment, Yokogawa provides solutions and services that will enable a digital transformation (DX) in their businesses, and is paving the way for a future in which industries will make the transition from industrial automation to industrial autonomy (IA2IA).



**HELLENIC
PETROLEUM**

“ Within our refinery that is the most complex in south west Europe, we have been using the CENTUM family DCS since 1984. Throughout this period our system evolved from a basic DCS to the latest generation CENTUM integrated with MIS and APC. In the current situation we still have parts of the initial system running, though fully integrated with the latest technology. Additionally, I am happy to say that all these implementations did not affect shutdown schedules at any time. ”

-Hellenic Petroleum
Aspropyrgos Refinery

- 03** The Smart Industry Readiness Index (SIRI) is rapidly becoming the global standard for industrial digitalization assessment. Yokogawa helps customers assess their organization's current priorities for their manufacturing digitization investments and programs.

Digital transformation to autonomous operations

Achieve Operational Excellence

Leading Edge Technology, Consulting, and Optimization Solutions



A Yokogawa Company

World-class technology and consulting services for designing, operating and managing hydrocarbon production and processing facilities - everything you need to take your business to the next level.

Our foundation of collaboration, clear communication, and impartial advice is supported by deep industry knowledge and operational experience. We combine this with flow assurance, integrated best-in-class production modeling, technical process engineering skills, and our advanced simulation tools to develop and deliver practical solutions with measureable results. KBC enables clients to sustain these benefits by preparing the organization for change and providing training and tools to support sustainable success.

Engineering Technology

- Process simulation
- Refinery reactor simulation & modeling
- Flare system simulation & modeling
- Energy management systems

- Multiphase PVT modeling
- Integrated production modeling

Consulting

- Strategy & business excellence
- Production optimization
- Operations management
- Human performance improvement

Cloud Solutions

- Joint venture data sharing
- Remote operational excellence
- Simulation as a cloud service
- Model calibration and update
- Live data-based training
- Sustained performance solutions.

Commitment to deliver



Shared Vision

with long-term partnership



Best-in-Class

operating performance & robust technology from sensor to enterprise



Secure Integration

based on solid project management



Sustainable Support

through global reach and local delivery

BU-P-20210924-01

Yokogawa Corporation of America
12530 W. Airport Blvd.,
Sugar Land, TX 77478
www.yokogawa.com/us

Yokogawa Canada, Inc.
Bay 4, 11133 40th Street SE,
Calgary, AB T2C 2Z4
www.yokogawa.com/ca

Yokogawa de México, SA de CV
Urbina No. 18
Parque Industrial Naucalpan
Naucalpan de Juárez, Estado de México
C.P. 53370
www.yokogawa.com/mx