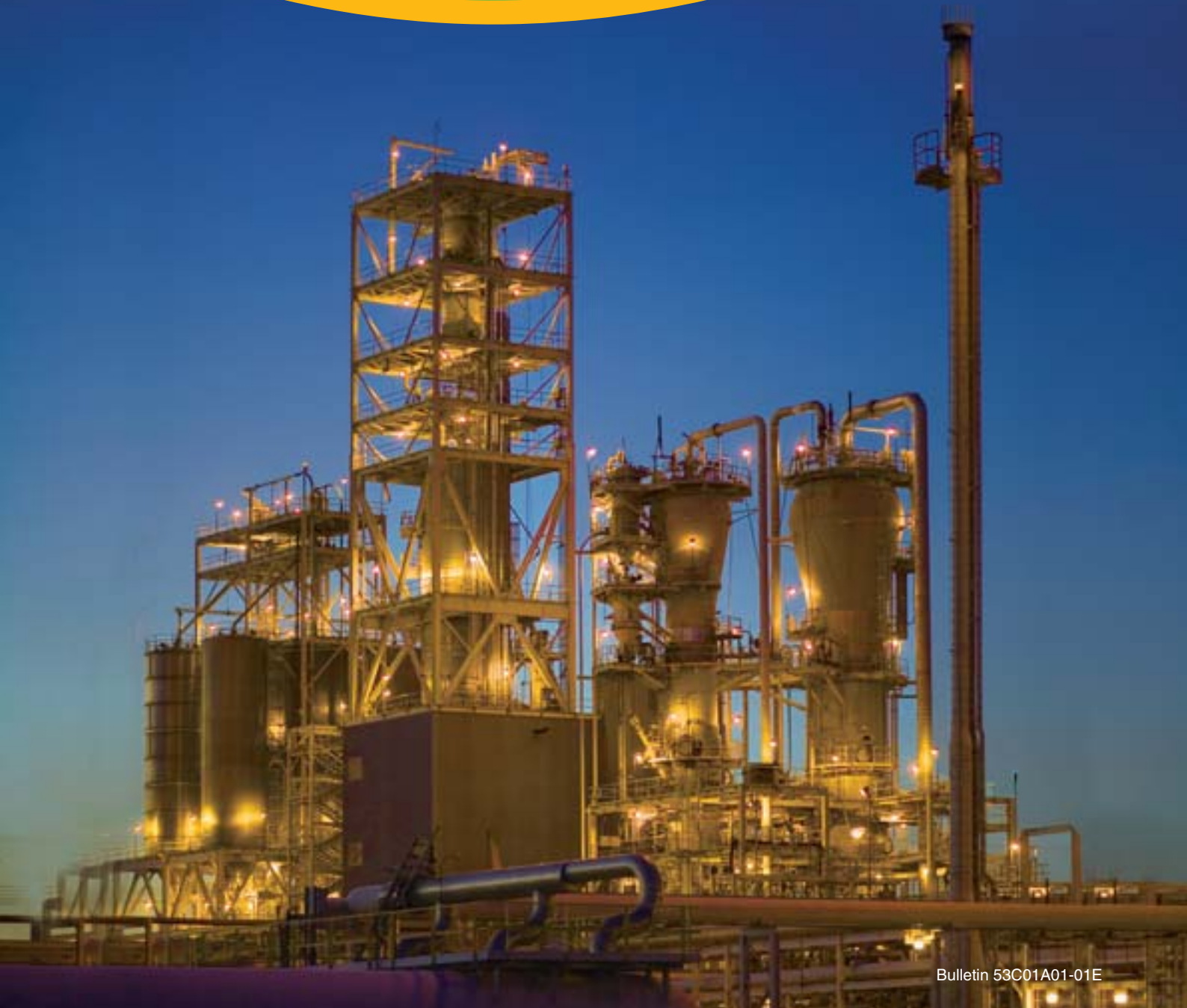


Yokogawa in the Petrochemical Industry

Yokogawa's VigilantPlant solutions deliver visibility, predictability and agility for your petrochemical business.



Bulletin 53C01A01-01E

vigilantplant.[®]
The clear path to operational excellence

YOKOGAWA 

vigilantplant.®

The clear path to operational excellence

Envision a plant where people are watchful and attentive while your business responds to change quickly and efficiently. Now picture an operation that delivers non-stop production while confidently expanding your capabilities into the future. Imagine no further. This is the vision and promise behind VigilantPlant, the clear path to operational excellence.

Does your petrochemical plant look silent and boring?

To a casual observer, a petrochemical plant, well-managed by Yokogawa VigilantPlant solutions, looks "silent and boring" - a phrase used by Peter Drucker. Plant profitability is maximized. Automation systems help plant personnel manage operational knowledge, increase productivity and comply with health, safety, and environmental regulations. Information in context is clearly delivered to the right people at the right time, giving responsible personnel the foresight to deal with events calmly and efficiently. VigilantPlant solutions help all petrochemical companies to achieve a "silent and boring" plant.



ACT WITH AGILITY
Free of bottlenecks
Reduce delays, lost opportunities,
knowledge silos

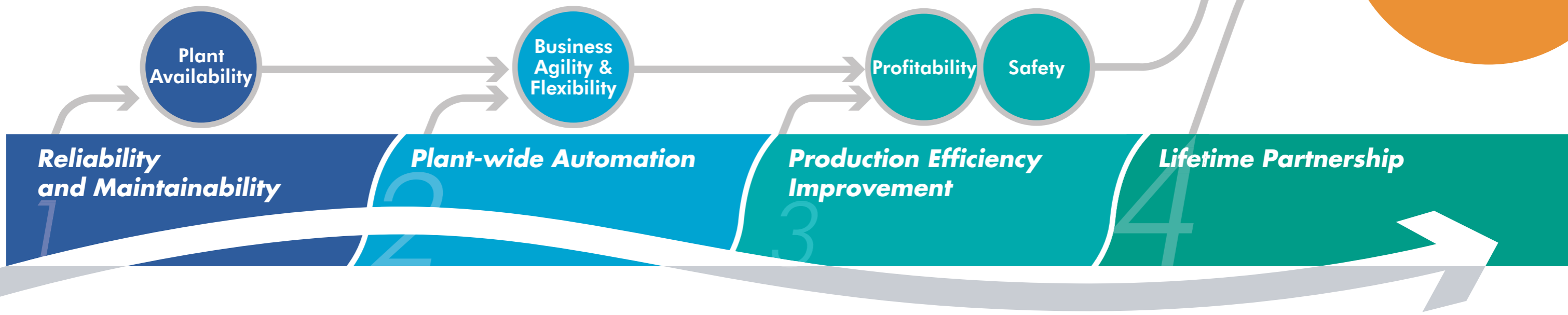
Minimize reactive measures,
unexpected downtime, quality variations
Fewer surprises
KNOW IN ADVANCE



SEE CLEARLY
Less blind spots
Avoid guesswork, instability,
sub-optimization

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

Long-Term Business Success



“Reliability and maintainability” of automation systems maximizes 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 prerequisite for petrochemical plants.



“Plant-wide automation” enhances agility and flexibility of petrochemical production workflow



Yokogawa is an automation supplier with extensive hands-on understanding of the usage of information for complex and varied petrochemical production processes. Yokogawa is a premier supplier of integrated plant-wide automation solutions that delivers agility and flexibility to the petrochemical production workflow.

“Production efficiency improvement” increases profitability and enhances health, safety and environment

Customers' needs are extremely diversified. To come out ahead in today's highly competitive marketplace, petrochemical companies are striving for quality and productivity improvements. At the same time, they share a greater commitment to addressing HSE issues. Yokogawa provides tailor-made solutions to these needs based on its long and wide-ranging experience in this field.



“Lifetime partnership” maximizes total value of ownership



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.

“Reliability and maintainability” of automation systems maximizes 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 prerequisite for petrochemical plants.

Reliability is in our DNA

Reliability of the production control system

All automation suppliers take system reliability - a key factor for petrochemical plant availability- seriously. However, none matches Yokogawa in its extreme commitment. At the heart of all of the company's system is the unique “Pair and Spare” controller architecture, consisting of a redundant set of CPU modules that, in turn, each contains two micro processors. The two micro processors constantly compare each other's outputs, initiating a bump-less switchover if any mismatch is detected. The actual availability track record of Yokogawa CENTUM CS 3000 DCS reaches 99.99999% (seven 9s).

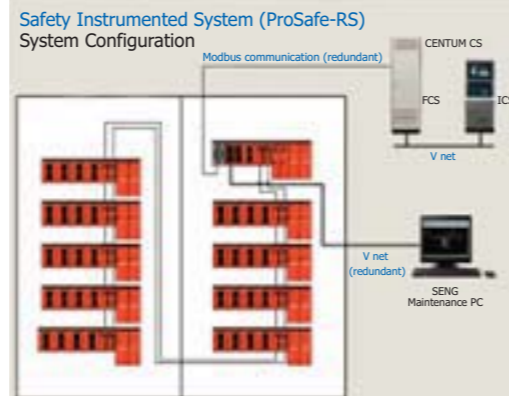
Reliability of the safety instrumented system (SIS)

Yokogawa's safety instrumented system, ProSafe-RS, is the world's first, truly integrated safety instrumented system and more than just a shutdown system. Its integrated architecture with the production control system enables unified monitoring and an operation environment for the operator. TÜV Rheinland (TÜV), a German certification organization, has certified ProSafe-RS to be compliant to both IEC 61508 and IEC 61511 international standards. Additionally, TÜV has approved its use in Safety Integrity Level3 (SIL3) *1 applications, such as Emergency Shutdown (ESD), Fire and Gas (F&G) and Burner Management (BMS). This latest certification of IEC 61508 and IEC 61511 compliance attests to the high level of Yokogawa's technology and the quality of its safety instrumented system.

(*1) To be certified for SIL 3, safety systems must be tested by a third party for a risk reduction factor that measures more than 1,000.

Nippon Petrochemicals Co., Ltd.

“We employed the ProSafe-RS Safety Instrumented System because it is compliant with the IEC 61508/JIS C 0508 functional safety standards.



Our ProSafe-RS system has improved reliability by incorporating redundant CPU and I/O modules to avoid unnecessary trips triggered by system abnormalities, not by true safety concerns.

We feel that safety instrumented systems are becoming essential in emergency shutdown systems in Japan and in other countries, and that we must add corporate value by further strengthening plant safety.”

Improving maintainability by diagnostic technologies

Improved plant maintenance

By taking advantage of FOUNDATION fieldbus™, or HART connections with the field devices, Yokogawa's asset management system, PRM (Plant Resource Manager) system greatly improves device maintainability that reduces maintenance costs. Now maintenance staff can gain access to field device information anywhere anytime. The system enables staff to set and modify field device parameters, and to check detailed device alarm information. Standard audit trail management allows the tracking of changes to device information.

Device diagnosis

With the introduction of FOUNDATION fieldbus™ technology and compatibility with HART, the results of field device self-diagnostics can be accurately reflected in DCS control operations. Examples of self-diagnostics include:

- Valve positioner
 - Signature diagnosis
 - Valve stick-slip diagnosis
- Differential pressure / pressure transmitter
 - Clogging diagnosis
 - Orifice wearing diagnosis
 - Diaphragm corrosion diagnosis
- Temperature transmitter
 - Temperature element diagnosis
- Vortex flowmeter
 - Clogging diagnosis
 - Vibration diagnosis

For even greater maintenance efficiency based on predictive maintenance, the system also provides advanced diagnostic functions. With these functions, staff can define and perform diagnostics using information from multiple devices or higher level process-dependent diagnostics. Advanced diagnosis examples include:

CNOOC and Shell Petrochemicals Company Limited (CSPC)

The largest FOUNDATION fieldbus™ installation in the world



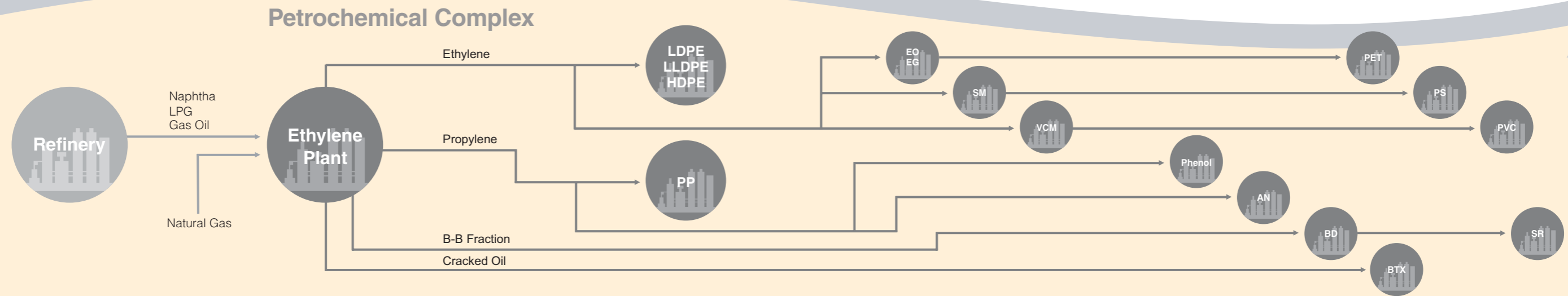
PRM, a real-time device management and advanced diagnostics software package, connects to the 16,000 FOUNDATION fieldbus devices and enables a problem to be diagnosed and an alert issued before the instrument actually fails and disrupts a process. The system continuously monitors the health of the instrumentation, resulting in increased reliability and fewer suspect measurements. With this preventive maintenance capability, plant operators can have greater confidence that their facility will perform as expected. There are 200,000 software I/O tags and around 3,000 segments, and these are controlled by nine CENTUM CS 3000 distributed control systems and 120 field control stations (FCS).

- Differential pressure / pressure transmitter
 - Impulse line blocking diagnosis
 - Steam tracing diagnosis
- Valve positioner
 - Instrument air-line clogging diagnosis
- Temperature transmitter
 - Environmental temperature monitoring

Yokogawa's innovative asset management system provides all the functionality necessary for efficient maintenance of your field devices.

“Plant-wide automation” enhances agility and flexibility of petrochemical production workflow

Yokogawa is an automation supplier with extensive hands-on understanding of the usage of information for complex and varied petrochemical production processes. Yokogawa is a premier supplier of integrated plant-wide automation solutions that delivers agility and flexibility to the petrochemical production workflow.



Field Sensing and Actuation

“Install and forget” digital field instruments deliver stable and accurate process measurement with low installed cost, near zero maintenance and intelligence of self-diagnostics. As a true leader in fieldbus, Yokogawa brought the world’s first FOUNDATION fieldbus™ enabled device to market and has since developed a complete range of FOUNDATION fieldbus™ instrumentation.



Analytical System

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



Harsh-environment CCTV

Compact, high performance and explosion-proof monitoring cameras exemplify Yokogawa’s commitment to constructing reliable field instruments that are able to withstand even the most severe environments. They are used in a petrochemical plant for monitoring operations day and night.



Production Control System

Ultra-reliable broadband control systems increase profitability by maximizing production.



Safety Instrumented System

Yokogawa offers a full-lineup of safety instrumented systems from solid-state and hard-wired types to fully integrated DCS-SIS integrated types, covering all safety integrity levels (SIL 1 to 4) for the petrochemical industry.



Production Management Solutions

Production Management Solutions from Yokogawa help operations achieve more plant profits and provide a bridge between real-time process systems and corporate systems. OPC communication, Process Historian, Batch Historian, Alarm and Event Analysis, Knowledge Based Automation, Electronic Log Book, Yield Accounting, Tank and Inventory Management, and EPR System Communication solutions are available.



Advanced Process Control & Optimization Systems

Advanced Process Control and online optimization achieve more profitable operations in petrochemical plant. The solutions are available for ethylene, polyethylene, polypropylene and aromatic plants, etc.



Asset Management System

Plant Resource Manager (PRM) makes predictive maintenance easy. Early detection of system and device failure can help prevent catastrophic failure.



Alarm Management System

The Consolidated Alarm Management System (CAMS) is practical and has an immediate effect. Rather than solely relying on rigorous top-down alarm design and redesign, Yokogawa enables a practical, overarching real-time alarm management system that delivers the right information to the right people at the right time.



Control Room Consolidation

Yokogawa helps design the central control room and delivers solutions for the control room consolidation, entire and effective plant operations, workforce rationalization and optimum organization.

“Production efficiency improvement” increases profitability and enhances health, safety and environment

Customers' needs are extremely diversified. To come out ahead in today's highly competitive marketplace, petrochemical companies are striving for quality and productivity improvements. At the same time, they share a greater commitment to addressing HSE issues. Yokogawa provides tailor-made solutions to these needs based on its long and wide-ranging experience in this field.

The Aromatics Thailand Public Co. Ltd. (ATC)

“We are impressed by Yokogawa APC Solutions, and we are satisfied with Yokogawa service. Currently, our operators enjoy working with APC. Our APC uptime can meet with ATC's KPI which is at least 95%. We look forward to have more technology and service from Yokogawa.”

Ms Jeeranee, Technical Department Manager, ATC



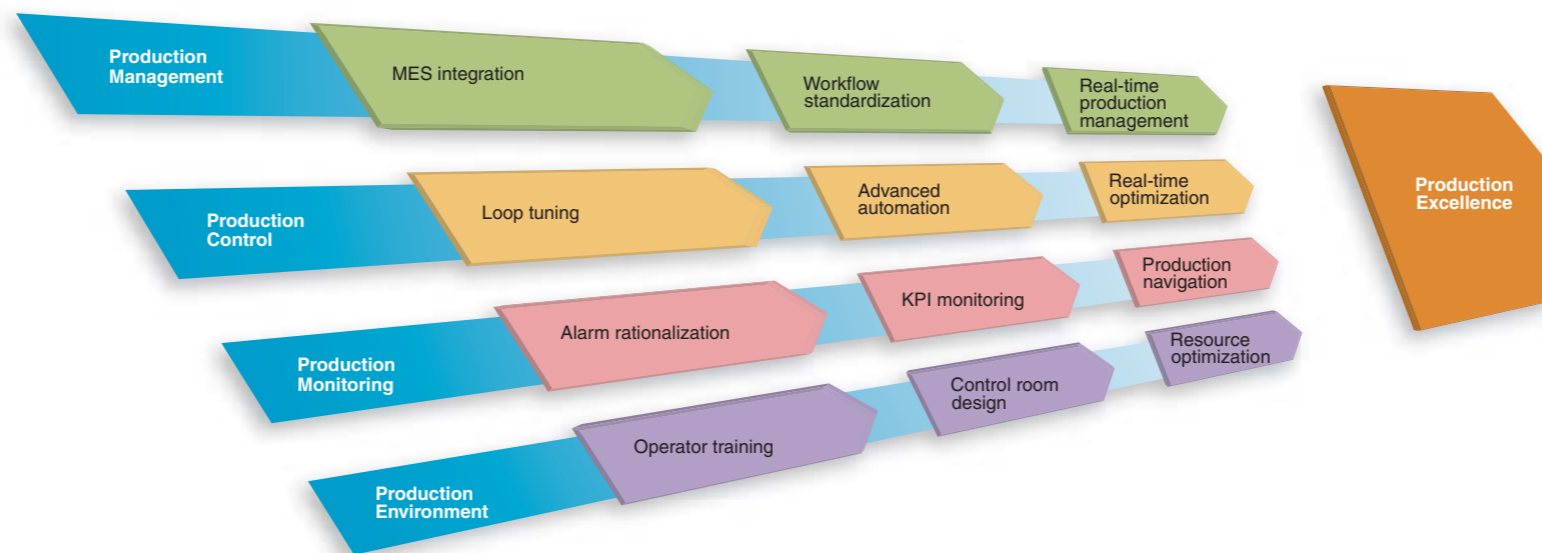
Customer Challenges

- Raise throughput 3%
- Improve product quality
- One year project delivery schedule

Results with Yokogawa APC and CENTUM

- Raised throughput 3% when post audit test
- Generated US\$1M annual benefit
- Achieved higher process stability
- Achieved product quality specifications and minimized quality giveaway
- Knowledge and skills of plant staff upgrade

The Clear Path to Production Excellence



Production Management

MES integration

A variety of individual systems that perform scheduling and other functions are included in the manufacturing execution systems (MES) domain. The connectivity among systems is a fundamental key enabler for agile production management.

Workflow standardization

Production workflows should be defined and monitored for reliable production management. The standardization of workflows is especially effective at companies with multiple production sites.

Real-time production management

Overall real-time production management is required to speed up the production Plan-Do-Check-Action (PDCA) cycle.

Production Control

Loop tuning

PID control plays a fundamental role in process control. Proper tuning is required for stable process control and is a prerequisite for advanced-level control.

Advanced automation

Advanced process control and knowledge-based navigation systems are key contributors to a well-automated operation.

Real-time optimization

Plant-wide optimization can be achieved with a real-time optimizer using rigorous model calculations.

Production Monitoring

Alarm rationalization

An approach to alarm management based on the well-known Engineering Equipment & Materials Users' Association (EEMUA) No.191 guideline is recommended. Alarm root cause analysis is also an effective approach to successful alarm rationalization.

KPI monitoring

A wide variety of key performance indicators (KPI) should be monitored by each person. KPI monitoring requires comparison with targets and drilling down for detailed information.

Production navigation

Production tasks need to be managed correctly by the system. Task progress monitoring is a valuable bridge between planning and manufacturing that facilitates cooperation in production management.

Production Environment

Operator training

Operator training systems allow operators to gain experience in handling various situations such as equipment malfunctions and in performing start-ups and other routine operations. It helps operators upgrade their skills.

Control room design

Control room design needs to take into consideration all aspects of the work environment including ergonomics, safety, ease of communication, functionality, automation of systems, and business policy.

Resource optimization

A central control room is desirable for an effective production environment. All production-related units should be stationed nearby to ensure good communication. In addition to centralizing the control room, the optimization of human resources and other activities can be considered to achieve production excellence.

CNOOC and Shell Petrochemicals Company Limited (CSPC)

Operating philosophy

At CSPC's request, Yokogawa developed "DCS Anywhere" technology that will give access to the control room from any location within the site.

To control the field instrumentation, there are three control centers and fifteen field auxiliary rooms, and they are connected by fiber optic cables to form a plant control information network (PI-LAN).

The VigilantPlant concept of seeing clearly, knowing in advance, and acting with agility will play an important role in achieving a flawless plant startup.



“Production efficiency improvement” increases profitability and enhances health, safety and environment

Health, Safety and Environment Measures

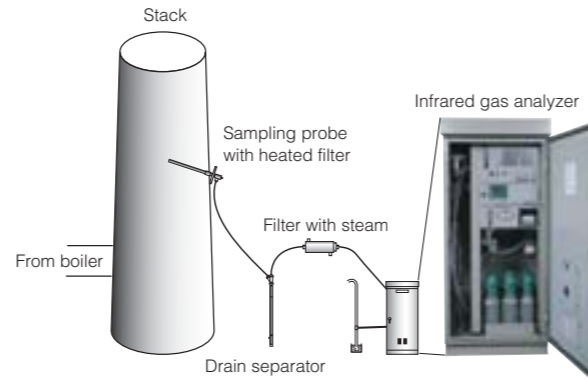
The economic environment is changing rapidly and competition now takes place on a global scale. In addition to adapting to these changes in the economic environment, the petrochemical industry must also respond to society's increased emphasis on health, safety and environment (HSE) issues. For the petrochemical industry to achieve growth under these conditions, it is crucial to develop competitive, value-added products, and to install flexible production systems that can quickly adjust to market

changes. This means that plant operations are now at a key turning point. They must reduce manpower and pursue other initiatives to operate more efficiently while at the same time maintaining safety and stability and implementing measures to protect the environment.

A number of Yokogawa solutions are introduced below that can help ensure plant efficiency and enhance HSE. The Yokogawa ProSafe-RS Safety Instrumented System (page 5) is also highly effective in improving plant safety.

Continuous emission monitoring

Our continuous emission monitoring system for utility boilers and heating furnaces utilizes an infrared gas analyzer to monitor CO, CO₂, NO_x, SO₂, CH₄, and O₂ concentrations in flue gas, helping bring petrochemical companies into compliance with environmental regulations.



Operator training

Less experienced operators tend to run into difficulties when they encounter new situations and unexpected problems, and this presents a serious challenge in maintaining HSE. Training operators with a simulator is one effective way to address this concern. Plant operators can be quickly brought up to speed in performing both routine and non-routine operations as well as troubleshooting.

Yokogawa's OmegaLand, integrated environment for dynamic simulator provides operators realistic training in a virtual environment. Training is available for procedures such as plant startup and load change, abnormal conditions such as an instrument or equipment failure, and emergencies such as earthquakes, fires, and runaway reactions.



Avoiding unnecessary plant shutdowns with effective alarm management

BEFORE

A Recurring Problem ...

Workloads often increase faster than process reengineering efforts, causing operators to be inundated with recurrent alarms.

Alarm flooding going unattended:

- Results in oversights, delays, and incorrect operations
- Leads to a higher risk of overlooking critical information that can lead to a hazardous situation



AFTER

... and a Vigilant Remedy

Avoid alarm flooding and empower your operators for safe and effective operations by using a practical, overarching, and real-time alarm management system.

Consolidated Alarm Management System (CAMS) :

Alarm rationalization

- Suppresses nuisance alarms
- Enables the right information to be delivered to the right people at the right time

Well-managed and real-time alarm management

- Sorting by priority in case of alarm flooding
- Alarm with operation instruction



"Lifetime partnership" maximizes total value of ownership

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.

Shell Oil Co., Norco, Louisiana

Fieldbus reinstrumentation project yields significant benefits

Here's how Shell upgraded from a pneumatic instrumented system to a fully digital control system

The Norco facility has long been one of Shell's most profitable chemical plants. But to remain profitable and competitive, Shell realized several years ago that it would have to update its instrumentation and controls. Also important were initiatives to reduce maintenance costs and, above all, meet the "bottom-line" goal of reduced steam-per-unit output for the entire plant. Shell entered into a business partnership with Yokogawa to transform a largely pneumatic instrumented plant into a fully digital plant using FOUNDATION fieldbus™ technologies. That investment is paying off with significant results. The essence of Shell's decision was to replace its legacy pneumatic control system with an integrated production control system.

Three decades of compatibility

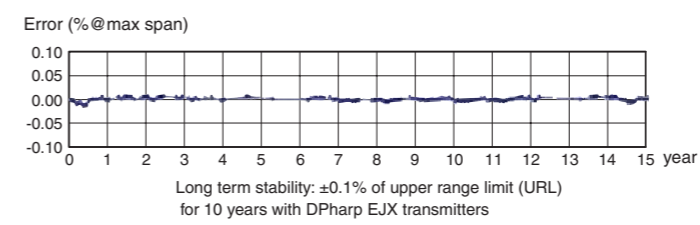
Consistency and long-term support are the hallmark of Yokogawa production control systems. From the very first CENTUM system introduced in 1975 to the latest CS 3000 R3 system, Yokogawa policy ensures effective migration and the smooth evolution of your plant.



Long-life product stability

Our latest DPharp EJX series pressure transmitter exemplifies Yokogawa commitment to delivering state-of-the-art yet field-proven solutions. Inheriting the DPharp full-digital silicon resonant sensor technology, the DPharp EJX sets a new standard for DP measurement. In addition to its unique capability to measure both differential pressure and static pressure, it is the world's leading transmitter in accuracy, stability, and response time.

DPharp EJX's stability guarantee incorporates over-pressure effects as well as temperature and static pressure, making it the world's most reliable transmitter in field applications. As a clear testimony to its fundamental stability and fail-safe design, TÜV has certified the DPharp EJX in its standard configuration (no options required) as a SIL2 safety transmitter.



Successes to date

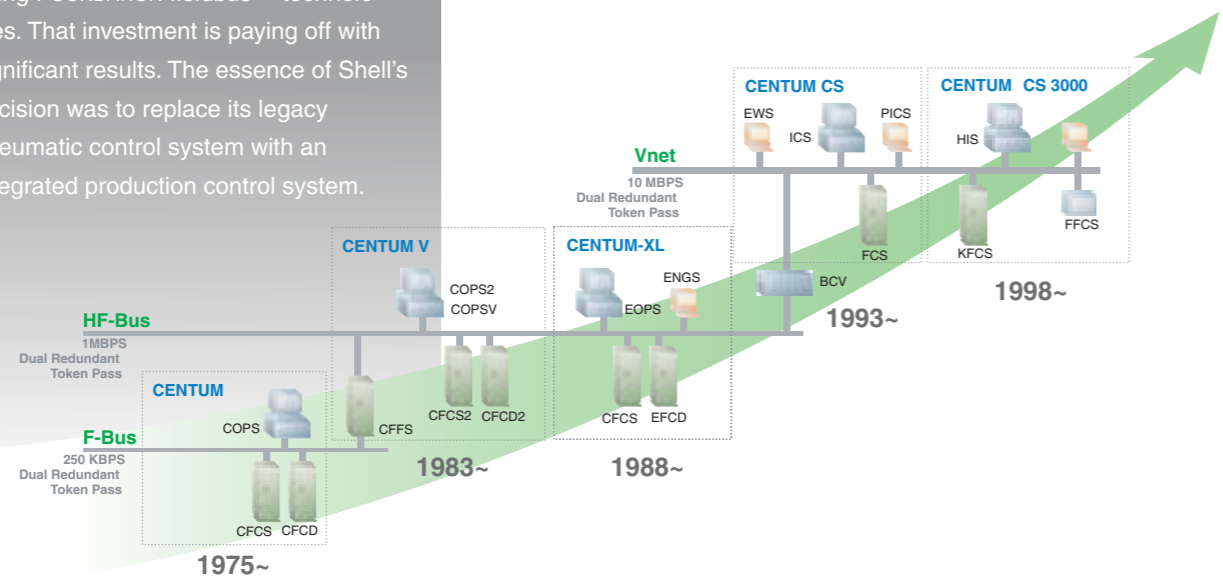
The control strategies for the loops remained unchanged except for reinstrumentation. Improvements, therefore, resulted primarily from process stabilization and more efficient utilization of the overall control system. Some milestones include:

- Improved operations through control of key variables to reduce process variability in several major units
- Early detection of potential device problems
- Zero unscheduled shutdowns or incidents
- High degree of operator acceptance
- Significant operation and maintenance benefits through predictive maintenance provided by FOUNDATION fieldbus and asset management technology

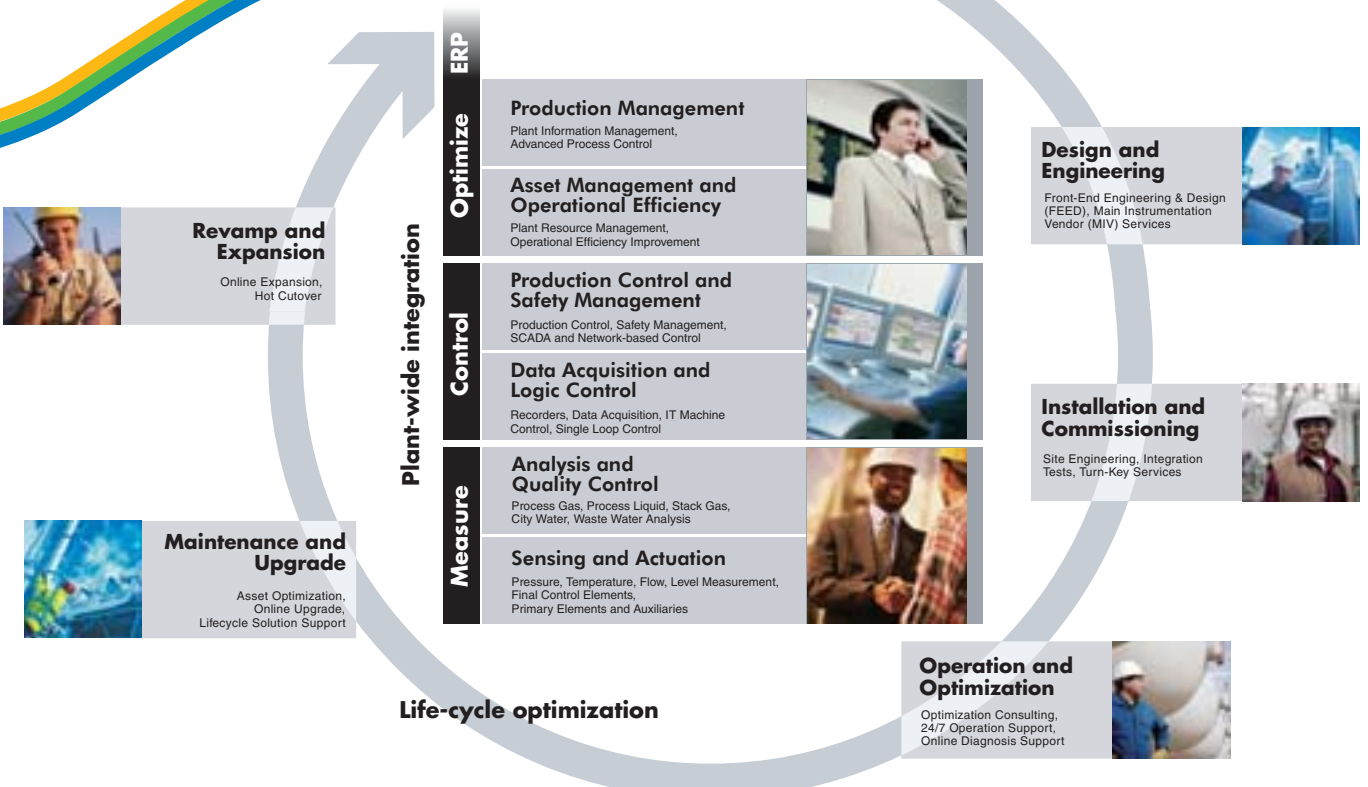
Preventive maintenance

- Time Based Maintenance (TBM)
- Maintenance performed at predetermined points based on an assumed failure rate
- Condition Based Maintenance (CBM)
- Individual equipment is monitored periodically.
 - Reliability is judged by use of diagnostics.

Yokogawa has developed advanced CBM diagnostics that include stress quantitative technology, deterioration failure detection analysis, and strength performance measurement. In the era of digital field networks, this digital information enables accurate equipment monitoring and predictive diagnostics.



VigilantPlant = The clear path to operational excellence



The clear path to operational excellence

SEE CLEARLY	KNOW IN ADVANCE	ACT WITH AGILITY
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VigilantPlant is Yokogawa's automation concept for safe, reliable, and profitable plant operations. VigilantPlant aims to enable an ongoing state of Operational Excellence where plant personnel are watchful and attentive, well-informed, and ready to take actions that optimize plant and business performance.

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