

## ARC WHITE PAPER

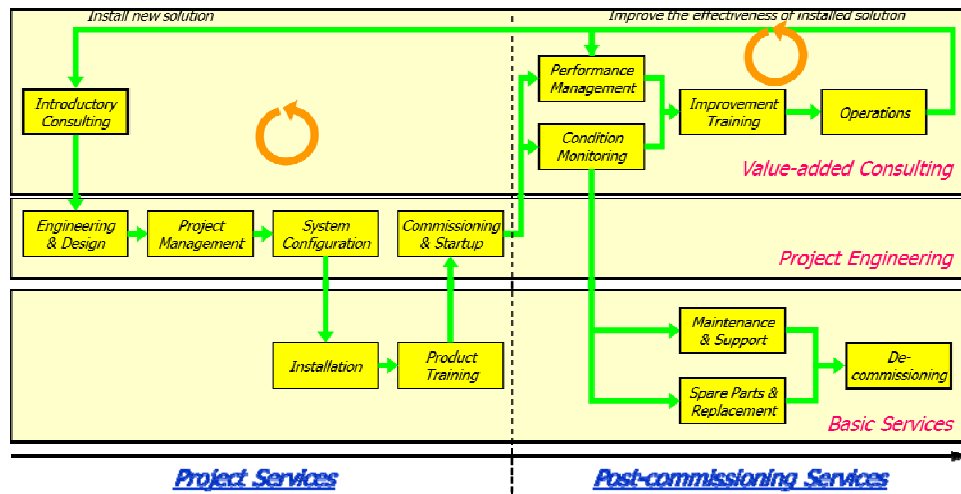
By ARC Advisory Group

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## Yokogawa VigilantPlant Services Cover the Entire Lifecycle of an Automation Asset

Vigilant Plant Services Line-up		Basic	Enhanced	Custom
AE	InsightSuiteAE			○
	Regulatory Control Stabilization			○
SE	Best Practice Pilot			○
	Alarm Rationalization		●	●
PE	Improvement Leader Development Program	●	●	●
	Comparative Effectiveness Analysis	●	●	●
Common				
LE	Normal Hours Technical Support	●	●	●
	Repair Support Services	●	●	●
	Engineer Dispatch Services	●	●	●
	Preventive Maintenance (Patrol Inspection)	●	●	●
	24 H Emergency Support (RMS)		●	●
	Parts Management		●	●
	Software / Hardware Revision Upgrade Facility		●	●
	Training			○
	Shutdown Maintenance Service			○
	Technology Refresh			○
	Renewal/Overhaul Service			○
	Environment Diagnosis			○
	Deterioration Diagnosis			○
	Network / Security Service			○

## Yokogawa Service Agreements Provide Clients with a "Menu" Approach

## Executive Overview

In today's dynamic industrial marketplace, the only constant is change. Raw material costs, energy costs, market demands, environmental and safety regulations, technology, and even the nature of the labor force itself are constantly changing, and not always in predictable directions.

To compete successfully in today's business environment, manufacturers must achieve continuous performance improvements. This includes improvements in efficiency, production, product quality and consistency, productivity, energy and resource consumption, emissions reductions, regulatory reporting, and supply chain.

To compete successfully in this business environment, manufacturers must achieve continuous performance improvements. This includes improvements in efficiency, production, product quality and consistency, productivity, energy and resource consumption, emissions reductions, regulatory reporting, and supply chain.

However, the current shortage of internal engineering and other technical resources will make it very difficult for industrial organizations to identify, implement, and maintain the kinds of short-term plant improvements offering the quick return on investment often sought in today's tight capital environment

With this in mind, Yokogawa – a leading global automation supplier -- designed a comprehensive lifecycle support mechanism for the company's clients facing these challenges. Yokogawa's **VigilantPlant Services** cover all three phases of an automation system's lifecycle with *project services* (engineering and design, project management, system configuration, commissioning and startup, etc.); *basic post-commission services* (system maintenance, spare parts and replacement, decommissioning, etc.); and more advanced *post-commissioning performance services*.

The latter category of services, which tend to be consultative in nature, focus on helping customers identify, implement, and maintain plant performance improvements that deliver rapid return on investment. These include opportunity identification, performance management, condition monitoring, improvement training, and operations optimization.

Since the post-commissioning operational phase of the system lifecycle can last 20 years or more, ARC believes performance services are critical for maximizing overall ROI for automation assets and that automation suppliers are in an excellent position to deliver these critical services.

## Competing Successfully in an Increasingly Challenging Environment

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Clearly, today's business environment is more challenging than ever before. In addition to ever-changing raw material costs, energy costs, market demands, environmental and safety regulations, and technology, it often seems like new competitors are emerging all the time. Many of these new competitors can offer acceptable-quality products at much lower cost than the well-established companies. And this competitive advantage is not only due to lower labor costs and less-stringent safety and environmental regulations. Increasingly, manufacturers in the emerging economies are building modern grassroots production facilities equipped with the latest manufacturing and automation assets.

To compete successfully in this business environment, manufacturers must achieve continuous performance improvements. This includes improve-

The lack of adequate internal engineering and other technical resources will make it very difficult for industrial organizations to identify, implement, and maintain the kinds of short-term plant improvements offering the quick return on investment often sought in today's tight capital environment.

ments in efficiency, production, product quality and consistency, productivity, energy and resource consumption, emissions reductions, regulatory reporting, and supply chain. As industry veterans know, given adequate resources, performance improvements such as these are not impossible to achieve.

But in the wake of years of ongoing corporate downsizing to cut overheads and placate shareholders (with plant engineering, IT, and maintenance groups hit particularly hard) most manufacturing organizations today barely have adequate resources left in place to keep the plant operating, much less implement continuous performance improvements on multiple fronts. The significant knowledge and skills drain that will accompany the impending wave of retirements anticipated as post-World War II "baby boomers" exit the workforce will only compound the problem. The lack of adequate internal engineering and other technical resources will make it very difficult for industrial organizations to identify, implement, and maintain the kinds of short-term plant improvements offering the quick return on investment often sought in today's tight capital environment.

In the past, it was not uncommon for manufacturers and other industrial organizations to look to their engineering and procurement contractors (EPCs), automation suppliers, or other third parties to help them imple-



**Global Automation Suppliers Can Offer Important Strengths for Delivering Services**

ment large-scale capital projects, such as building and equipping new plants or performing major plant expansions. However, ARC Advisory Group has identified a more recent trend in which, increasingly, industrial organizations are looking to their automation suppliers to help them identify, implement, and maintain smaller scale improvement efforts that can often be implemented using maintenance or other operational budgets. In other words, help them find and harvest the “low hanging fruit;” non-capital pro-

jects that will often provide payback within months, rather than years or even decades.

It was against this backdrop that Yokogawa introduced the company’s VigilantPlant Services (VPS) to the global trade press at the ARC World Industry Forum in Orlando, Florida in February 2010.

## **Vigilance and VigilantPlant Services**

### **A Little History...**

Traditionally, Yokogawa’s business focused on measurement and control and its CENTUM distributed control system (DCS) represented the company’s core product. Then, in the late 1990’s, Yokogawa announced its new corporate vision: Enterprise Technology Solutions, or “ETS.” This telegraphed the company’s intention to move from a product-centric to a solution-centric business model.

Beginning around 2002, Yokogawa decided to expand its oversea businesses, especially in United States. At the time, Yokogawa adopted the “Vigilance” theme to express its corporate “DNA” to US companies us-



**Yokogawa Senior VP,  
Satoru Kurosu,  
Introduces  
VigilantPlant Services  
to the Global Trade  
Press at ARC's 2010  
Orlando Forum**

ing a single word. Vigilance implies careful execution and reliable, nonstop support. It represents Yokogawa's business attitude - being steady, never giving up, and providing 24/365 support to customers. The Vigilance mindset represents a win-win-win scenario in which Yokogawa, the company's global customers, and society as a whole benefit.

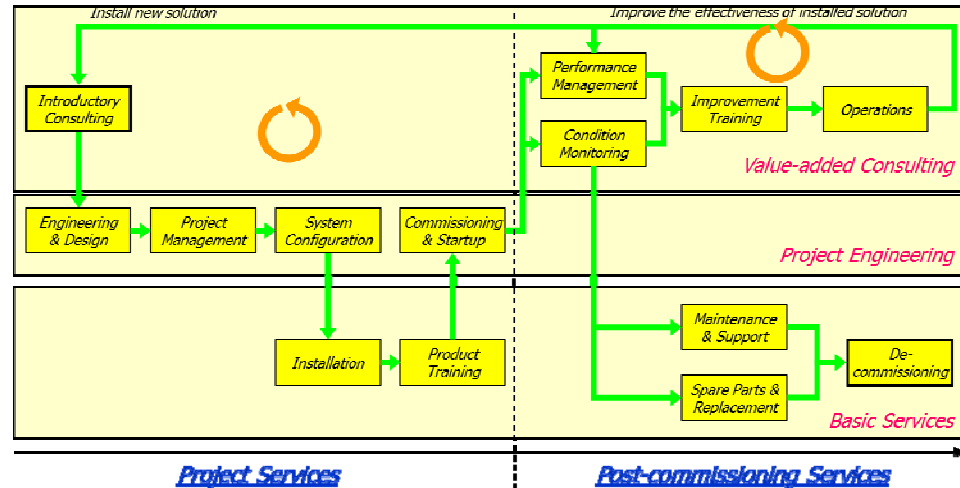
"VigilantPlant" extends this theme to the pursuit of the ideal plant. Customers overseas reacted well to these concepts. This translated into significantly increased international business for Yokogawa. So much so, in fact, that overseas sales eventually exceeded domestic sales in Japan.

In 2008, Yokogawa launched the company's Industrial Automation (IA) business in Japan based on VigilantPlant and supported by a series of VigilantPlant seminars around the country. Then, to strengthen the company's solution business and emphasize its transition from an automation supplier to a lifetime solution partner for its global customers, Yokogawa launched its VigilantPlant Services to the global trade press at a well-attended press conference at the ARC Orlando Forum in February 2010. Following seven months of additional preparation, Yokogawa officially rolled out its VigilantPlant Services to Japanese customers during this VigilantPlant Seminar 2010 in Osaka.

All in all, customers around the world have responded well to the "VPS" lifecycle partnership concept. To date, the company has signed approximately 100 VPS contracts of one type or another for clients in Asia, Europe, the Middle East, and the Americas. Client plants span the heavy process industries, including petroleum refineries, petrochemical plants, oil & gas operations, power plants, etc.

### **Overview of VigilantPlant Services Offering**

Yokogawa's VigilantPlant Services focus on plant automation-related areas, including health/safety/environment (HSE), production (operational excellence), and asset availability. Designed to provide a comprehensive lifecycle support mechanism for the company's clients, Yokogawa's VigilantPlant Services cover all phases of an automation system's lifecycle.



Project services are designed to help reduce upfront design and implementation costs and speed time-to-value for automation projects. Examples include:

- Introductory consulting for new automation solutions
- System engineering and design
- Project management
- System configuration
- System commissioning and startup
- Installation
- Product training

Basic post-commissioning services are designed to help improve automation asset availability. Examples include:

- System maintenance and support
- Spare parts management and replacement
- System decommissioning

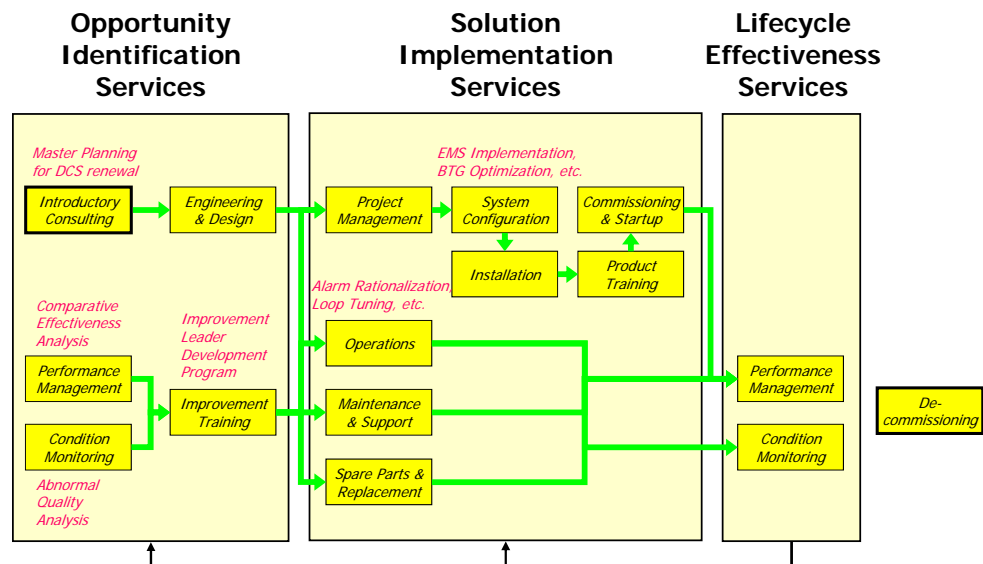
Performance-based post-commissioning services are designed to enable clients to continuously improve the effectiveness of installed automation assets. Examples include value-added consulting for:

- Performance management
- Condition monitoring
- Improvement training
- Operations effectiveness

For the company's critical post-commissioning performance services, upon which the balance of this ARC white paper focuses, Yokogawa has developed mechanisms to monitor and report the monetary benefits the client realizes following implementation of the performance improvement solution or solutions. This helps users justify the investment and provides a solid business case for investments in future performance services.

## What's New in VigilantPlant Services?

In recent months, Yokogawa has placed significantly increased emphasis on its performance-based post-commissioning services. This is because while the company understands that project services and basic post-commissioning services are important to clients, it also understands that its clients must achieve continuous performance improvements from their installed automation assets if they are going to succeed in today's business environment. To this end, the company has beefed up its existing performance services, adding innovative new performance services, many of which have already been implemented and proven their value in plants around the world. Yokogawa has also introduced several new, performance-based lifecycle agreements.



**Yokogawa Value-Added Consulting Services Fall into Three Logical Categories**



According to Yokogawa, these value-added consulting services are designed to assist clients in their ongoing efforts to ensure the health and safety of their employees, improve environmental compliance, maximize the availability and performance of existing automation and other manufacturing assets, minimize total cost of ownership, and optimize production. They fall into three logical categories: *Opportunity Identification Services* to help clients identify and prioritize potential improvements; *Solution Implementation Services* to help clients implement the identified improvements; and *Lifecycle Effectiveness Services* to help clients to maintain and enhance the improvements over time.

### **Opportunity Identification Services**

Yokogawa's Opportunity Identification Services are designed to help the company's global clients identify the improvement opportunities within their plants that best align with specific business objectives, particularly improvements that can be implemented relatively quickly and with minimum (if any) capital investment. Specific objectives can include reducing energy or raw material costs, increasing production, enhancing safety, maximizing yields, accommodating different feedstocks, reducing product variability, enhancing productivity, increasing overall equipment effectiveness (OEE), and improving return on assets (ROA).

Specific services that fall under the general category of Opportunity Identification Services include:

- Master planning for DCS renewal/upgrade
- Benchmarking operational performance
- Plant performance monitoring and analysis, and
- Training to develop internal improvement leaders

### **Solution Implementation Services**

To implement the solutions identified, Yokogawa performance improvement specialists often work hand-in-hand with the client's select group of trained internal improvement leaders. The former are well-versed in areas such as loop tuning, alarm management, advanced process control, simulation, optimization, and so on, while the latter naturally possess a more intimate understanding of the particular plant's specific human and other assets. These services typically focus on helping the client achieve excellence in safety, production, and asset performance and availability.

Specific solution implementation services include project management, system configuration, installation, commissioning and startup, and product training for:

- Alarm rationalization
- Loop tuning
- Boiler/turbine/generator optimization
- Energy optimization

### Lifecycle Effectiveness Services

Plants are always in a state of flux based on dynamic market demands; feedstock availability, variability, and costs; energy costs; equipment wear and tear; new regulatory requirements; availability and skill levels of human assets; and numerous other issues. That's why it's so important to monitor and maintain the performance solutions and make additional incremental improvements as needed.

In response, Yokogawa has expanded its traditional equipment maintenance support services with new *application maintenance services*. Application maintenance services are designed to help ensure that process control loops, advanced process control, alarm rationalization, and other key, performance-enhancing applications remain optimally tuned over time.

According to the press release that the company issued in February 2010 to announce VigilantPlant Services, "Yokogawa's VigilantPlant Services go beyond the scope of conventional [automation supplier-provided] services to address the sustainability of improvement initiatives."

### Lifecycle Agreements

Yokogawa recently expanded the scope of its performance-based services with formal lifecycle support agreements. These expand the client's potential to achieve and maintain asset excellence, production excellence, and safety excellence (though opportunity identification and lifecycle effectiveness services, discussed earlier). They also expand the traditional scope of maintenance coverage beyond the automation platform to include maintenance support for both *automation applications* and *plant networks*.

The company offers three levels of lifecycle support with these agreements with flexible package options using a services "menu" approach to enable

clients to obtain precisely the scope and level of support they require in a cost-effective manner. The three levels are:

1. Basic Support - includes both Comparative Effectiveness Analysis and Improvement Leader Development services plus selected services from the Lifecycle Effectiveness menu. The latter include technical support during normal business hours, repair support, engineer dispatch services, and preventive maintenance services.
2. Enhanced Support - includes all services included in Basic Support, plus alarm rationalization from the Safety Effectiveness menu and 24-hour emergency support, parts management, and software/hardware upgrade/revision facility from the Lifecycle Effectiveness menu.
3. Custom Support - includes all services included in Enhanced Support, plus the option to select a variety of additional advanced services from the Asset Effectiveness, Safety Effectiveness, and Lifecycle Effectiveness menus.

	Vigilant Plant Services Line-up	Basic	Enhanced	Custom
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	Training			○
	Shutdown Maintenance Service			○
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	Renewal/Overhaul Service			○
	Environment Diagnosis			○
	Deterioration Diagnosis			○
	Network / Security Service			○

**Menu of Services Included (or Available) in Basic, Enhanced, and Custom Lifecycle Support Agreements**

## Yokogawa's Advantages as a Services Supplier

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ARC research indicates that all major automation suppliers with global presence are in a relatively good position to deliver automation platform-related pre- and post-commissioning services to their clients. In general, major automation suppliers have in-depth familiarity with their own automation platforms, familiarity with the majority of their clients' vertical industry applications, and the global "footprint" required to actually deliver services to client's plants around the world. However, a select handful of global automation suppliers – Yokogawa among them – have unique capabilities and characteristics that enable them to excel as service providers.

To begin with, Yokogawa's "sweet spot" as an automation supplier, is in the extremely demanding heavy process industries such as petroleum refining, petrochemicals, oil & gas, and power generation. To emerge as a trusted supplier to customers in industries such as these, a supplier must possess an in-depth knowledge base, develop highly skilled personnel, and earn a reputation as a supplier that both executes with vigilance and stands behind its customers.

### "Hybrid" Improvement Methodology

For the company's value-added performance services portfolio, Yokogawa has developed a "hybrid" improvement methodology that combines many of the best elements of the bottom up-style Japanese Kaizan approach, with the best elements of the more top-down approach to business and process improvements often encountered in the Western world.

The Kaizan approach, which focuses on an ingrained continuous improvement mentality at all levels of an organization, forms the basis for many of today's well-accepted quality improvement philosophies. It provides a basis for companies to continuously improve the performance of their existing assets.

However, the company understands that -- particularly for companies headquartered in North America and Europe -- improvement efforts are likely to be a bit more programmatic in nature, and will be initiated by top management, if not the CEO him or herself. These efforts also often involve acquiring additional assets to obtain the desired improvements.

## **Knowledge Gained the Hard Way**

Certainly, like their customers, all global automation suppliers operate in a challenging environment. However, as the headlines attest, the industrial environment in Japan presents a number of unique challenges. To begin, with it's well known that while Japan is blessed with much natural beauty, the nation as a whole suffers from a lack of natural resources. Virtually all raw materials and fossil fuels need to be imported, often from distant countries. Thus, to compete successfully in a global marketplace, Japanese manufacturers must learn to optimize their consumption of these raw materials and fossil fuels, while complying with some of the world's strictest environmental and safety regulations.

This situation became significantly more challenging due to the strict power and other restrictions that followed the earthquake and tsunami disaster last March. These brought down much of the nation's power generating capacity and wreaked havoc on transportation. Japanese companies, many of them Yokogawa customers, bounced back from these constraints to resume essentially normal production levels surprisingly quickly, due in part to their suppliers' exemplary support capabilities.

## **Standardized Methodology for Delivering Services**

For several reasons, it's important for global service suppliers to be able to deliver their services in a consistent manner anywhere in the world. For one thing, most global customers demand this. Consistent delivery practices also enable the suppliers themselves to develop reproducible service solutions and deliver proven, high-quality services in a cost-effective manner.

Yokogawa solution implementation services are designed and delivered using a well-honed approach using the Six Sigma, DMAIC (design-measure-analyze-improve-control) process. This helps to ensure both quality and consistency.

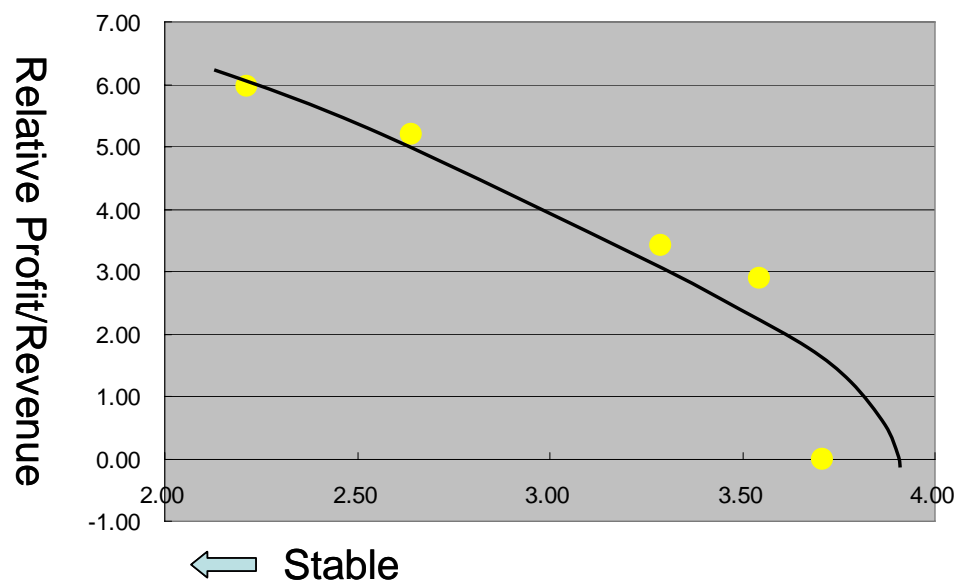
## **Internal Consultant Development**

While the company's center of excellence for VigilantPlant Services is based in Japan, its service specialists and performance consultants are based around the world. To help ensure uniform service delivery capabilities from these geographically dispersed human resources, the company has

implemented a standardized, ongoing training and professional development program for its performance improvement service providers. This combines formal classroom training with virtual on-the-job training using advanced plant and system simulators.

## VigilantPlant Services in Action

Yokogawa's VigilantPlant Services group has performed extensive research into the correlation between asset effectiveness and profitability at a number of Ethylene companies. In all cases, the results indicate clearly that a well-tuned automation platform helped generate significant incremental profit for the companies studied.



**Normalized Total Effectiveness Index Indicates Correlation between Effectiveness and Profitability in Selected Ethylene Plants**

Several examples of industrial organizations across different vertical sectors and in different locations around the world that have achieved measurable benefit from the application of Yokogawa's value-added VigilantPlant Services follow.

## **Large-Scale Control System Migration Planning**

As part of a large-scale modernization program, the Moscow Refinery of JSC (Joint Stock Company) Gazprom Neft in Russia decided to migrate its existing production control and safety instrumented systems to current technologies to help improve both safety and efficiency. At the time, operators monitored and controlled the refinery from approximately 40 local control room distributed throughout the large facility. To help develop and implement a cohesive road map for this complex, large-scale migration project, refinery management approached Yokogawa, which applied its Master Planning methodology to conduct the needed studies and help the refinery produce the roadmap. Following a five-month study, Yokogawa created a migration plan for the production control systems designed to ensure safety, while minimizing production interruptions during the migration/consolidation project. This featured a phased consolidation of the existing control rooms. Gazprom Neft anticipates that the resulting improvements to production efficiency and productivity will yield sufficient profits for the company.

## **Alarm Rationalization to Improve Safety**

Proper alarming is critical for safe and stable plant operations. However, ARC research indicates that many process plants suffer from an overabundance of alarms. This is largely because it's relatively easy (and essentially cost-free) to configure alarms in modern DCSs. The resulting nuisance alarms can overwhelm the operators. EVALCA, the US business unit of EVAL, a major Belgium-based manufacturer of Ethylene Vinyl Alcohol copolymer resins, was averaging close to 20,000 alarms per day at its Texas polymer production plant. This is well above the number recommended in the EEMUA alarm management guidelines. Faced with this problem, the company utilized Yokogawa's Alarm Rationalization service to help reduce nuisance alarms by 93 percent, resulting in significantly safer and more stable plant operation.

## **Productivity Improvement by Best Practice Pilot**

The Ehime plant of Nippon A&L Inc. produces a variety of different plastic products. Here, complex startup operations requiring a large number of manual operations previously created a heavy burden for the plant's operators. In conjunction with Yokogawa engineers, the plant collected and analyzed data that clearly exposed the problem. The team implemented a

Best Practice Pilot solution that included procedural automation of selected manual operations and operation procedure standardization for those procedures that could not be automated. The team applied Yokogawa's Exapilot operational efficiency improvement software package to help integrate the expertise of skilled operators into automatic sequences and operational guidance. As a result of this project, which made extensive use of Yokogawa engineering and consulting resources, the plant succeeded in reducing startup time dramatically and reducing manual operations.

### **Reducing Costs and Carbon Dioxide Emissions by Optimizing Boiler/Turbine/Generator Control**

The Takasago Plant of Kaneka Corporation is a large consumer of energy, which is becoming increasingly expensive. As part of a strategic initiative to reduce these costs and minimize carbon dioxide emissions, the company worked with Yokogawa engineers to implement an advanced process control (APC) solution to optimize control of the complex operation patterns in its boiler, steam turbine, and generator (BTG) facilities, in which most of the plant energy is consumed. The team implemented the APC in conjunction with Yokogawa's Exapilot operations efficiency improvement software package which helps automate manual operations. As a result the plant succeeded in both reducing its fuel costs and carbon dioxide emissions and reducing labor requirements.

### **Increasing Plant Operational Flexibility**

Today's process plants must maximize operational efficiency to match ever-changing operating constraints, costs, and product sell prices. The TANCECO refinery in Russia worked with Yokogawa, in its role as main automation contractor (MAC) to implement an advanced manufacturing execution system (MES) solution. Now, both operations and planning staffs can share the same data in real time to improve operational flexibility to maximize the refinery's objectives in a dynamic environment.

### **Field Digital Device Diagnostic Service**

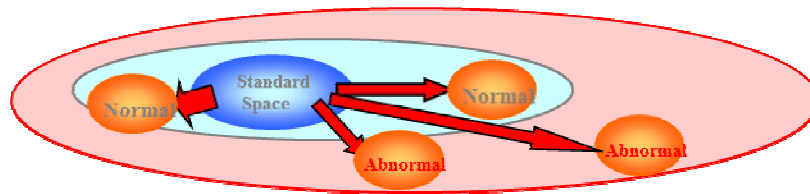
To help determine the actual health of the large number and variety of digital devices installed throughout this large facility, Mitsubishi Chemical Corporation's Kashima Plant took advantage of Yokogawa's Field Digital Device Diagnostics Service to analyze the large amount of device-related



data stored in the plant resource manager (PRM). The resulting Field Asset Key Performance Indicator Report provided a visual summary of device statuses, alarms, and events. This clearly identified particularly problematic areas, enabling the plant's maintenance group to prioritize its activities. In addition to helping optimize field devices parameters for more effective operation, the diagnostic report identified previously undetected backup sensor defects in the plant's safety system, which could have led to a costly (and unnecessary) plant shutdown.

## Future of VigilantPlant Services

As Yokogawa evolves from an automation platform supplier to a lifetime solutions supplier, the company continues to invest in new service delivery capabilities (personnel, facilities, technology, etc.) as well as developing new VigilantPlant Services. For example, the company is working to enhance its range of monitoring and analysis services with a new *Abnormal Quality Analysis Service*. Ultimately, this will provide the company's improvement providers with another powerful tool to help identify appropriate areas for improvements in customer plants.



### Multivariable Data Analysis Technology Helps Determine the Distance between Standard Space and Abnormal Space

Based on multivariable data analysis technology, this approach uses advanced pattern recognition technologies that closely approximate the way human beings process data to determine the data correlation between the standard space and abnormal space. This can be used to identify product quality variations that indicate sub-optimal performance.

## Challenges and Recommendations

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ARC Advisory Group believes that Yokogawa made the correct move when it decided to transition from a product-focused automation supplier, to a solutions-focused supplier.

Yokogawa's umbrella "VigilantPlant" theme has resonated well with its global customers and its lifetime-performance-focused, VigilantPlant Services offering also appears to be gaining traction - particularly with its petroleum refining and petrochemicals customers in Japan and other selected countries.

The company's umbrella "VigilantPlant" theme has resonated well with its global customers and its lifetime-performance-focused, VigilantPlant Services offering also appears to be gaining traction - particularly with its petroleum refining and petrochemicals customers in Japan and other selected countries.

Moving forward, the company's challenge will be to continue to build its consultative performance services delivery capabilities in North America, Latin America, and Europe and to build domain knowledge and credibility in additional vertical industry segments.

It will also be critical for Yokogawa to continue building up its portfolio of current reference sites for performance services to help demonstrate the potential benefits in a variety of plant applications and across multiple geographies.

**Analysts:** Paul Miller and Barry Young

**Editor:** Dick Hill

**Acronym Reference:** For a complete list of industry acronyms, refer to our web page at [www.arcweb.com/Research/IndustryTerms/](http://www.arcweb.com/Research/IndustryTerms/)

<b>API</b>	Application Program Interface	<b>HMI</b>	Human Machine Interface
<b>B2B</b>	Business-to-Business	<b>IOP</b>	Interoperability
<b>BPM</b>	Business Process Management	<b>IT</b>	Information Technology
<b>CAGR</b>	Compound Annual Growth Rate	<b>MIS</b>	Management Information System
<b>CAS</b>	Collaborative Automation System	<b>OpX</b>	Operational Excellence
<b>CMM</b>	Collaborative Management Model	<b>PAS</b>	Process Automation System
<b>CPG</b>	Consumer Packaged Goods	<b>PLC</b>	Programmable Logic Controller
<b>CPM</b>	Collaborative Production Management	<b>PLM</b>	Product Lifecycle Management
<b>CRM</b>	Customer Relationship Management	<b>RFID</b>	Radio Frequency Identification
<b>DCS</b>	Distributed Control System	<b>ROA</b>	Return on Assets
<b>EAM</b>	Enterprise Asset Management	<b>RPM</b>	Real-time Performance Management
<b>ERP</b>	Enterprise Resource Planning	<b>SCM</b>	Supply Chain Management
		<b>WMS</b>	Warehouse Management System

Founded in 1986, ARC Advisory Group is the leading research and advisory firm for industry. Our coverage of technology from business systems to product and asset lifecycle management, supply chain management, operations management, and automation systems makes us the go-to firm for business and IT executives around the world. For the complex business issues facing organizations today, our analysts have the industry knowledge and first-hand experience to help our clients find the best answers.

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