

Automating the Upstream

With no let-up in global energy demand and an increasing need to exploit newer sources of oil and gas, the upstream exploration and production sector continues to provide a well of opportunities for automation suppliers.

By G Venkatesh.

A chain is as weak as its weakest link. Automating the downstream processes in the oil & gas industry may be fine and of course mandatory, but this surely should not be at the expense of a well-functioning, safe and efficient upstream component – read exploration and extraction. Systems thinking has perpetrated into many sectors of industry and that augurs well for sustainable development. Even as people talk of sufficiency and demand management as indispensable for sustainable development, sustainable and safe production and efficient operations upstream will fuel the motors of the economy, while not detracting from environmental upkeep, safety, security and social welfare.

According to Henry Lau, regional senior vice president and managing director at AspenTech, a software supplier to the process industries, upstream oil & gas companies need to keep pace with growing demand and drive incremental revenues by exploiting hydrocarbon reserves. This trend is particularly significant in fast-emerging regions where operators are aggressively pursuing new market opportunities.

“These opportunities include finding and developing new reserves and equally extending the production life of existing assets. Achieving these twin goals presents a range of related challenges to operators,” he says.

Indeed, the related challenges that Lau alludes to sets the ball rolling on trying to understand the role of and the need for automation solutions in the upstream segment of the oil & gas sector.

Clear returns

For process automation suppliers the oil & gas sector has always been a main revenue source and with no evident let-up on the demand side, this is likely to be the case for the foreseeable future.

Vidya Ramnath, vice president, wireless & marketing, Emerson Process Management Asia Pacific, informs *CE Asia* that automation solutions for the upstream oil & gas sector account for nearly one-third of the company’s business mix, with Emerson’s clientele reading like a “who’s-who” of the oil & gas industry. She also points to the 2009 acquisition of Norwegian company Roxar, which added subsea expertise and technology to Emerson’s strength in topside and onshore processing.

According to ARC Advisory Group, the demand for petroleum products will increase substantially as the economies in developing regions improve and per capita energy consumption increases. And as today’s production and processing capacities struggle to keep ahead of the demand curve, both upstream and midstream facilities will need to be expanded.

“New sources, such as tar sands, shale oil, and coal-to-liquid gas, will require new midstream and production facilities to be developed, increasing demand for automation systems and field devices,” notes ARC, which also predicts Asia’s share of sales for global upstream oil & gas automation to reach 25 percent by 2013.”

In a study released in 2010, Frost & Sullivan reported a doubling in upstream expenditure by the oil & gas industry in Malaysia over the previous five years, and noted almost 40 percent of new discoveries being in deepwater.

“With output declining from mature shallow water fields, deepwater field development is a major area of activity in the Malaysian upstream sector, and deepwater projects require more capex for development,” said the company’s Asia Pacific associate director, Energy & Power Systems Practice, Subramanya Bettadapura.

“Gumusut-Kakap, Malikai, Kebabangan, Jangas, Ubah Crest, Pisangan, Kamunsu are the deepwater fields that are being developed. Most of these are expected to come on-stream in the 2010 to 2015 period,” outlined Bettadapura. In another report released at the end of last year, Frost & Sullivan identified SCADA (supervisory control and data acquisition) systems as a main beneficiary of increasing oil and gas demand, with new infrastructure investments in the Middle East, Africa, Asia Pacific, Latin America and Russia spurring SCADA markets to grow rapidly in these regions.

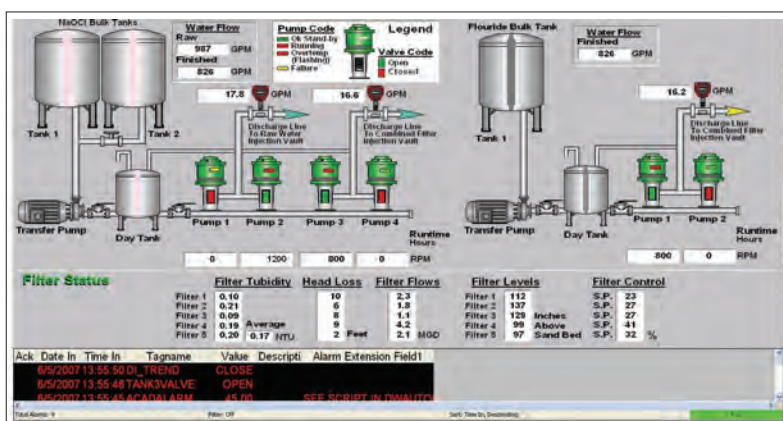


“Oil exploration in Siberia, the North Sea, the Gulf of Mexico and North Western Africa has gained renewed interest,” said Frost & Sullivan research analyst Katarzyna Owczarczyk. “The need to control geographically dispersed assets drives cash-rich oil majors to invest in SCADA systems, thereby supporting market expansion.”

The report also noted that natural gas is becoming increasingly important in the energy market globally due to its comparatively clean emissions, relatively low price, and abundant availability, therefore being an alternative to oil and coal for electricity generation. The gas pipelines needed to reach end users require SCADA monitoring for leaks, flow, and routing, further promoting market expansion.

“The concept of piped distribution, when implemented, will create numerous opportunities for automation companies in terms of supplying SCADA systems,” according to Owczarczyk. “Demand for SCADA solutions will surge since distribution will involve the transportation of gas over long distances.”

This positive sentiment for SCADA is shared by ARC Advisory Group. “SCADA systems, together with advanced applications, improve visibility and the performance of geographically dispersed assets, and form the basis for real-time performance management of production and pipeline assets,” said Allen Avery, principal author of the *SCADA Systems for the Oil & Gas Industry Worldwide Outlook* study from January this year.



Their ability to monitor and control geographically dispersed assets bodes well for SCADA systems adoption upstream.

Lessons from the Gulf

After the notorious Deepwater Horizon incident in the Gulf of Mexico in 2010, among operators, the need for extremely reliable and industry-proven equipment combined with excellent commissioning and product lifecycle management has become increasingly important.

Robert Wine, press officer for BP, when quizzed about the imperativeness of automation for, or rather the consequences of the lack of it on safety of upstream operations, refers to BP's own investigation report drawn up after the Gulf of Mexico catastrophe last year.

It is evident from the report that automation is necessary but not often sufficient to ensure safety of operations. It is not just in the operation phase that automated controls play an important role, but further upstream as well, in the manufacturing and production facilities supplying the materials, components and equipment which are utilized in the exploration and extraction processes. Some of the conclusions of BP's own investigation team throw light on both the deficiencies of the existing controls, as well as the implications for automation technologies in the oil & gas sector in the years to come.

For example, the rig crew's first apparent well control actions occurred after hydrocarbons were rapidly flowing to the surface. Here, efficient controls could have enabled prompt action. And the heating, ventilation and air conditioning system likely transferred a gas-rich mixture into the engine rooms, causing at least one engine to over-speed and create a potential source of ignition. Here, efficient controls could have averted such an incident.

At times, a single barrier does not suffice. Over-reliance on a single automated control would mean turning a blind eye to its limitations. Controls often function well when there are multiple lines of defense, or multiple barriers in other words, between an incident (event) and the avoidable catastrophe.

Incidentally, Robert Wine also points out that that it is not possible to strip out automation as a separate cost element, as the automation develops along with the technologies developed by the company for its exploration and extraction activities.

Going onshore

While Deepwater Horizon was offshore, in North America, bearing in mind the geopolitical concerns around the reliable supply of oil and gas, and the rising demand for energy in the economies – Canada, USA and Mexico – recourse has been taken, over the years to non-conventional onshore sources of natural gas – shale deposits

for instance. The “fracking” process – fracturing the rocks to enable the flow of gas upward and above the surface is fraught with dire environmental fallouts which affect the quality of the groundwater. Chris Tucker, of Energy in Depth, an organization of independent companies engaged in natural gas drilling (to draw up gas from terrestrial shale deposits) in the US, thinks that the move towards automation in the context of upstream shale operations represents a natural progression for this industry, and one that's driven by several key factors – starting with cost.

“In a world in which natural gas costs US\$4, producers really need to take a hard look at where their efficiencies will be found. As it has been throughout history, the smart use of technology is often the best place to start that search,” says Tucker.

“Obviously, the process of seeking out diffuse, tightly-packed shale gas resources two miles underground is already one that has been ruled out at each and every

step by cutting-edge technology. But to the extent it moves even further in that direction, it's likely to produce measurably better outcomes across a whole host of important categories,” says Tucker.

It is apt to quote AspenTech's Henry Lau again. “Operators across the global upstream industry will increasingly need access to the highest-quality process optimization solutions to drive project efficiencies, keep costs under control, sustain workforce productivity and support knowledge transfer. Those that achieve this combination are likely to be most successful both in exploiting new reserves and in capitalizing on existing assets.”



Energy in Depth's shale gas operations in the US: there is an increasing need to seek out new sources of oil and gas.

'We create technically advanced exploration & production automation solutions'

Vidya Ramnath, vice president wireless & marketing, Emerson Process Management Asia Pacific, on the company's offerings for the upstream of the oil and gas (O&G) sector.

Q: How significant is the oil & gas sector for Emerson Process Management?

A: Our business mix by industry is diversified and balanced, though there is clearly a great deal of emphasis on the oil & gas space. It currently represents more than one-third of our annual revenues, not including the downstream activities. Emerson's customer base consists of all of the multinationals, major independents and the majority of national oil companies, including China Petroleum Corporation (Sinopec group), StatOil, BP, ConocoPhillips, ExxonMobil, Fluor, PDVSA, Pemex, Petrobras (Brasil), Qatargas, Saudi Aramco, Shell, Suncor Energy, and Total SA.

Q: And for their upstream activities, what can Emerson offer to such clients?

A: Exploration and production (E & P) solutions are part of the Emerson's integrated automation solutions that span from subsea oil and gas reservoirs, to platform and floating production, to transmission, and ultimately to the refining and production of goods.

E & P experts provide consultancy for addressing owners' reservoir management problems including subsea and down-hole. Process automation services help the owners in maximizing the production of topside and onshore facilities.

Emerson creates technically advanced E & P automation solutions by leveraging the PlantWeb digital plant architecture that uses predictive field intelligence to improve production uptime and performance. This architecture networks technology brands such as Rosemount transmitters, Fisher valves, Daniel flow meters, Micro Motion sensors, the DeltaV DCS, and Roxar technology for reservoir management and production optimization.

Q: Could you explain more about Roxar?

A: The acquisition of Roxar in May 2009 enabled Emerson to add subsea reservoir management and production optimization for global upstream exploration and production customers. The subsea expertise and technology has been combined with Emerson's topside and onshore processing knowledge to create integrated automation offerings for customers.

Roxar solutions, built on a knowledge of reservoir flow dynamics, combine real-time data from multiphase flow instruments, with predictive models from software to help operators monitor production continuously, observe and control oil and gas fields from remote locations, process large volumes of vital reservoir data quickly and use the most up-to-date field information when making operational decisions.

There are specific solutions for Reservoir Interpretation, Reservoir Modeling and Uncertainty Management, Reservoir Simulation, Well and Completion, and Production and Process Management. Continuous R&D across the full range is bringing innovative solutions to end users, including for example the latest versions of Roxar Tempest full reservoir simulation tool, and Roxar Enable history matching and uncertainty estimation software,

Q: Any implications from the BP Deepwater Horizon disaster for automation service providers like Emerson?

A: The importance of predictability, people, and performance in oil and gas facilities has once again been brought into sharp focus, by

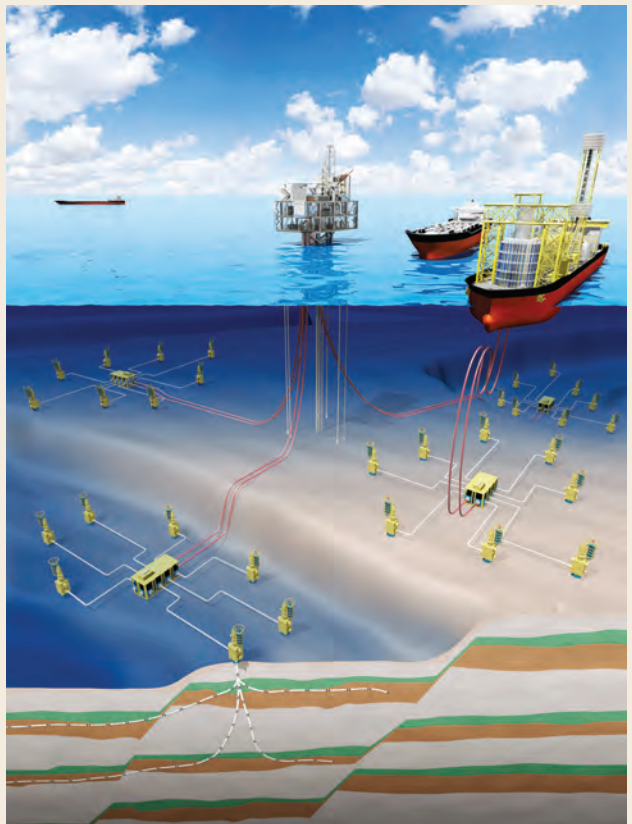


Vidya Ramnath, Emerson Process Management Asia Pacific.

what happened in the Mexican Gulf in 2010. Whereas process control and automation systems represent a small part of such project investments – three to five percent typically – they do enable the long-term safe and profitable operation of production assets.

Optimizing production performance comes down to a couple of simple factors. Firstly, by providing the right predictive technologies that provide greater insight into what is really happening with the production processes, customers can enable their people to make more informed decisions, and make those decisions sooner.

And secondly, by focusing on technologies which enable better decision-making, the limited resources our customers are able to put offshore can be in better control of the operation and more dynamically tune the process for safe, profitable operation.



The 2009 acquisition of Roxar has enabled Emerson to add subsea reservoir management and production optimization to its upstream offerings.

'Oil & gas operators need to ensure that they exploit new reserves as efficiently as possible'

Henry Lau, senior vice president and managing director, regional sales and services, APAC, AspenTech, explains how appropriate process engineering solutions can help to address the increasing complexity of operations in the upstream oil & gas sector.

Today's upstream oil and gas companies are focused on keeping pace with growing demand and driving incremental revenues by exploiting hydrocarbon reserves. This trend is particularly significant in fast-emerging, dynamic new markets such as Brazil, Russia, India and China (BRIC) where operators are aggressively pursuing new market opportunities both domestically and further afield.

These opportunities include finding and developing new reserves and equally extending the production life of existing assets. Achieving these twin goals presents a range of related challenges to operators.

Operators across the global upstream industry will increasingly need access to the highest-quality process optimization solutions to drive project efficiencies, keep costs under control, sustain workforce productivity and support knowledge transfer. Those that achieve this combination are likely to be most successful both in exploiting new reserves and in capitalizing on existing assets.

New exploration has the inherent risk of finding new reservoirs, can be very expensive and is often in challenging locations. By extending the life of existing assets and production systems the risk of the resource base is minimized and the location challenges are at least known. Oil and gas production is notoriously complex to manage and difficult to optimize due to the sometime unpredictable nature of reservoirs. As with exploration, expense is always a challenge. Operational costs are rising and internal expertise is increasingly scarce as a mature workforce retires.

The right solutions

Taken together, these trends are stimulating demand for a potent combination of technology and talent. Operators require high-quality process engineering solutions to address complexity of operations, which are accurate, robust, user friendly and help drive user productivity.

The best of these solutions are capable of delivering engineering efficiency throughout the design lifecycle whether they are used to help achieve minor modifications and revamps to facilities or to deliver efficiency across brand new assets used in the world's largest mega-projects.

Getting to "first oil" as quickly as possible is important but choosing the right assets to develop is critical. Fortunately, to support these twin business objectives, operating companies can now draw on a range of process engineering, cost estimating and integrated engineering solutions, such as those provided by AspenTech.

Existing fields decline in productive capability as they age. The International Energy Agency (IEA) calculates the average output decline rate from existing fields at 4.5 percent per year. This is where facility management solutions are instrumental in helping the business through the life of the asset.

Once again, technologies, including both the "hard technologies" of sensors, materials, etc, and "softer" ones like modeling,



Henry Lau, AspenTech.

optimization, real-time data and business processes solutions, have a vital role to perform. These are often grouped under the terms of "digital oilfield" technologies and have been touted by companies in this sector for many years. Widespread adoption is now making this a best-in-class business practice.

Optimizing assets

While all oil & gas operators need to ensure that they exploit new reserves as efficiently as possible, it is equally critical that they optimize their existing assets. A typical asset (field) may produce only 30-40 percent of the resource in the reservoir. More effective production, including the use of directional

and horizontal drilling, can drive the recovery number much higher.

Equally, production management technologies and decision-support applications can help avoid production losses through plant upsets and unplanned shutdowns and so help realize maximum asset potential. Technology can also play a key role in delivering real-time data and simulation models to drive understanding of the complex processes involved.

As in a classic manufacturing model, understanding the processes and how wells, compressors and separators interact, for example, can help drive down cost and improve reliability. Companies have achieved three to seven percent more production and, in certain cases, have increased recovery by as much as four percent from better operations. One customer reports achieving considerable benefits in its complex network of separation and gas processing facilities, including reduced energy consumption and increased capacity and planning time.

Tackling skills shortages

Understanding of production processes, which are often in a non-steady state mode (i.e. dynamic), requires models to help maintain control to ensure safe operations. Those same dynamic models can play an important role in training operators for these complex engineering processes. This is particularly important in the context of the issue of skills shortages, which is currently impacting the industry. Modeling technology can be vital here in helping operators to overcome challenges around changes to the asset and associated equipment. Decision-support applications, advanced process control (APC) solutions and operator training systems, which are capable of linking training to "real world" industry issues can help manage the skills shortages issue.

In addition, performance monitoring can be used to track the safe operation of the asset while, with dynamic simulation, operators can run what-if scenarios to validate the effectiveness of safety systems. The right technology will allow automation of the more mundane tasks and enable vital engineering skills to be deployed where they can be used most effectively. It will also assist those coming new into this sector to assimilate the knowledge they need from retiring colleagues with their years of relevant hands-on experience, thus helping to optimize knowledge transfer from one generation of engineers to the next.

'Oil & gas is now the largest vertical market for Rockwell Automation'

Eric Fidler, oil & gas director, and Elizabeth Parkinson, market development, oil & gas industry, Rockwell Automation, tell *Control Engineering Asia* about the company's growing capabilities for the sector.

Q: What can Rockwell Automation offer customers in the oil & gas industry?

A: Our overall strategy is solution based. We offer customers in this industry control, safety, and information management solutions that help them capture the most value from their assets. The PlantPax Process Automation System is key to our strategy, and everything we do is built around that solution set to the customer. Our acquisitions of ICS Triplex and Rutter Hinz have also given us a solid delivery capability: over 800 people serving customers' needs in process control, safety control, and information management all over the world.

Q: In which segments of the industry are you most active?

A: Oil & gas is now the single largest vertical market for Rockwell Automation. We sell our power control solutions – motor control centers, variable speed drives, etc – right across the sector, i.e upstream and downstream. But if you look at where we have had the most success with PlantPax then that would be in the upstream and transportation (pipelines) segments. Today, the bulk of industry investment is taking place in the upstream environment and that is where we are focusing our efforts.

Q: How significant is Asia for you?

A: We are busy in all the areas of Asia where oil and gas activity goes on, such as China, India Vietnam, Thailand, Singapore, Malaysia, Indonesia, and Korea. Over the last year we hired a leader for our Asia business; invested to grow our sales resources in order to drive our solutions into the large accounts; and beefed up our presence in China so as to raise the level of attention given to the three major government-owned companies.

Our Asia Pacific strategy also leverages on the solution provider network we have in the region. These partners can offer direct market access to certain customers or certain application knowledge that we may not have.

Q: What is Rockwell's competitive differentiator in the oil & gas industry?

A: Total cost of ownership (TCO) and system performance. With PlantPax we can offer not only a low installed cost but also a delivery and support model that helps them to lower their TCO. We also believe that we have a performance advantage through the flatness of our architecture, from the ability to interface to other control systems without gateways, and through being able to offer multiple control disciplines from one environment.

Q: Are you seeing a greater stress on safety since the Gulf of Mexico incident?

A: Yes, because of its severity and all the publicity around it, a more intense focus on safety by the industry is inevitable. Rockwell Automation offers a modular approach that allows the customer to build the degree of fault tolerance or fail safe that they need in their system. It's called Aadvantage, and you can get to SIL 3 with simplex I/O and two processors because of the diagnostics we have built in. We can also offer a full TMR (triple modular redundancy) system for larger systems when customers require it.



Elizabeth Parkinson and Eric Fidler, Rockwell Automation.

Q: From the FactoryTalk information solutions suite, which products are most relevant for this industry?

A: A key one would be VantagePoint EMI, which provides unified access to virtually all plant data sources, and produces web-based reports, such as dashboards and trends. It provides the ability to pull data from different applications and deliver role-based visualization, so that each person can focus on the information he or she needs. The software can also be used for workflow automation in areas like Well Test Validation and Automatic Well Allocation. Increasingly, more companies are deploying strategies related to the digital oilfield concept, and our information solutions really enable those processes.

CEA



The 2007 acquisition of ICS Triplex made Rockwell a serious player in process safety.