

Optimising LNG performance

Jon Taylor, Rotork, provides insight into the strategies that LNG terminals can use to optimise performance and prolong lifespan through efficient flow control and effective maintenance.

In recent years, LNG has emerged as a crucial component of the global energy mix, with LNG exports experiencing exponential growth. The US alone doubled its LNG exports to Europe in 2021, underscoring the increasing relevance of LNG in addressing the rising global demand for natural gas, which is expected to grow by 10% by the end of the decade.¹ As LNG plays a pivotal role in the lower-emission hydrocarbon bridge of the energy transition, it is necessary to explore the significance of efficient flow control throughout the LNG value chain, focusing on the importance of effective maintenance plans in LNG applications.

The expanding LNG landscape

The LNG industry is poised for substantial expansion, with liquefaction capacity projected to see major growth and regasification capacity anticipated to increase significantly by 2030.² The infrastructure needed to accommodate this growth presents challenges in many parts of the world. LNG's ability to serve as a lower-emission hydrocarbon bridge necessitates substantial investments in liquefaction, regasification, and transportation infrastructure. This infrastructure expansion emphasises the critical role of effective flow control, requiring reliable actuators and flow control solutions to ensure a smooth



operation from liquefaction and extraction to regasification, transport, and distribution.

Cryogenic valve challenges and solutions

In the cryogenic part of the LNG process, large quantities of gas are transported at extremely high pressures and controlled with actuated valves between 36 in. and 72 in. dia. It can be converted into a liquefied condition by applying pressure to the natural gas and reducing its temperature using compression trains and cryogenic systems. Valves and related equipment must withstand the extremely low temperatures involved (-162°C).

Cryogenic valves are usually constructed from type 316 stainless steel due to its ability to maintain its strength at extremely low temperatures. To prevent potential hazardous events and prioritise operator safety, valves regulating LNG flow must adhere to stringent safety standards such as BS 6364. Actuators controlling the valves must offer safe and dependable operation in continuously hazardous conditions.

Throughout this process, the inherent risks associated with the high-pressure gas necessitate robust safety measures. Emergency shutdown systems are critical components in managing potential hazards. Recognising this vital need, LNG operators rely on well-established and reliable solutions. Since the first LNG plants were built in the 1960s, Rotork has been a partner of such sites. Its pneumatic actuation systems provide large valves with the high-speed closure capability and torque required for effective emergency shutdowns.

Rotork's GP and CP pneumatic scotch yoke actuators are widely used in LNG terminals across the globe. Moreover, they reliably operate ball and butterfly cryogenic valves within



Figure 1. Intelligent actuators in operation at a terminal.



Figure 2. Scotch yoke actuators in service at a marine terminal.

storage and regasification plants. Certified to IP 66M/67M standards and equipped with corrosion-resistant cylinders, these actuators are well-suited for the challenging environments of the LNG industry.

High standards of safety certification are paramount throughout the LNG supply chain. The Safety Integrity Level (SIL) serves as a benchmark for performance expectations in safety systems. It is integral to a comprehensive functional safety plan encompassing techniques, technologies, and procedures designed to mitigate potential hazards. Recognising the importance of a life-cycle approach in managing hazardous processes, Rotork has worked to ensure that both GP and CP actuators achieve SIL3 certification for single-device operation as per IEC 61508, demonstrating their effectiveness for handling hazardous substances.

While many valves remain open during normal operation, operators require absolute confidence in their ability to close swiftly when needed. These products can be equipped with Rotork's PICO system to provide a partial stroke testing function.

The value of intelligent actuation when transporting LNG

Using bulk carriers is one of the most common methods to transport LNG across long distances. Actuators for process control are mounted on these specialised LNG carriers.

For example, during LNG shipping, safe, dependable, and efficient flow control management of liquefied gas into containers is reliant on intelligent electric actuators, such as Rotork's IQ actuators. Extensive real-time and historical feedback data via data logs (such as warnings, valve torque profiles, and the quantity of valve movements/operations) is another benefit of using intelligent actuators for LNG flow management. Explosion-proof certified actuators can ensure long-term dependability even in the most challenging conditions.

Another option is electro-hydraulic actuators, which combine the mechanical spring-return or accumulator fail-safe action's dependability with the accuracy of hydraulic control and the simplicity of electrical operation. Skilmatic SI actuators have been certified for hazardous areas and are commonly used for remotely operated shutdown valve (ROSoV) functions and ESD inputs pertaining to functional safety. For usage in these applications, they provide ESD options with single or dual inputs and partial stroke testing (PST).

The importance of actuation at the regasification stage

Regasification often takes place at coastal import terminals, which have specific requirements for handling LNG. The functionality of the actuators is a critical component of ensuring safe and dependable operation throughout the entire LNG value chain. Actuators are a common sight at automated tank farms. They perform isolating duties for regular flow control, modulating actions, and fail-safe activity for essential safety requirements. Intelligent electric actuators are also used in tank farms for safety-related purposes, such as Emergency Shut Down (ESD), which is crucial in case of hazardous situations.

Control and monitoring centres are critical to simultaneously controlling hundreds of actuators on LNG sites. Rotork's Master Station control system is used by LNG facilities all over the world, such as the Pengerang Deepwater Petroleum

Terminal in Malaysia, which contains two 200 000 m³ LNG storage tanks, a regasification facility, and berths for the loading and unloading of LNG tankers.

Utilising a field network, a Master Station can remotely manage hundreds of intelligent actuators, while the actuators regulate the flow of LNG. This technology provides dependable plant management and monitoring, which is essential in the LNG industry.

Helping reduce emissions with electric actuators

As the industry focuses on sustainability, the use of electric actuators emerges as a strategic choice to help reduce emissions. Retrofitting natural gas-powered pneumatic devices with electric actuators helps to reduce or eliminate methane and volatile organic compounds (VOC) emissions. This environmentally conscious approach contributes to a lower environmental footprint, improved regulation duty, and the increased reliability of LNG operations.

Throughout the LNG process, emissions can be reduced using electric actuators. In Belgium, Rotork upgraded an LNG terminal, a 4000 km pipeline, and an underground storage facility. Part-turn intelligent IQT actuators were installed to manage butterfly valves on boilers located in unmanned gas pressure-reducing stations. These valves are responsible for reducing the pressure of natural gas, allowing it to flow through a network that operates at a lower pressure or be transferred to an end consumer facility.

The installation of IQT actuators facilitated accurate flow control, emissions reduction, simple setup, diagnostics, and dependable operation. Rotork Site Services adapted IQTs onto existing valves at multiple locations. They offer continuous position tracking, even when there is no power available. IQTs are explosion proof in line with international standards, and are protected against water ingress (double-sealed) achieving a rating for water protection of IP66/68 at 7 m for 72 hrs.

Maintaining site operations

LNG flow control equipment is used in challenging operational and environmental conditions on a daily basis. These assets often work under abrasive, extreme-temperature conditions and are subject to excessive vibration, so it is essential that they perform reliably. The efficiency of these assets depends on the maintenance they receive to ensure their availability throughout the LNG journey.

When implementing a maintenance programme, it is crucial to consider the entire life cycle of an asset. Neglecting unsupported equipment can pose significant risks. However, by utilising specialised service and maintenance programmes, sites can effectively manage potential obsolescence and ensure that the site operates at peak efficiency with minimal unplanned downtime.

Asset failure due to poor maintenance can result in reduced performance, decreased quality and productivity, loss of investment, and severe environmental consequences. A site operator's responsibility is to ensure that the operation is running as effectively as possible to avoid unplanned downtime brought on by failing or underperforming equipment. Equipment failure can lead to catastrophic outcomes, so it is crucial to take proactive measures to prevent it.

The tiered system of reliability services

To manage potential issues that a site could encounter, an effective and comprehensive site service programme is essential. The programme needs to be affordable, easily accessible, and adaptable enough to meet the needs of the customer.

A reliability services programme can offer different levels of coverage based on three tiers: basic, standard, and premium. Customisable programmes increase asset availability and dependability while reducing downtime. Having the option for additional upgrades to suit the demands of the user is also an advantage. Adaptability is the key to maintaining consistent enhancement of a site's functionality.

The importance of taking into account an asset's whole life cycle cannot be overemphasised. Ageing equipment can have a number of concerns. However, with focused service and maintenance programmes, operators may manage obsolescence and sustain a site operating at optimum performance. Poor maintenance of assets can result in reduced performance, decreased quality and productivity, loss of investment, and severe environmental consequences. Site operators need to ensure their operation is running as effectively as possible to avoid failing or underperforming equipment. If equipment fails, the results can be disastrous.

One service Rotork can offer to help is its cloud-based asset management system for intelligent actuators and valves. The Intelligent Asset Management (IAM) system can provide comprehensive condition monitoring, anomaly detection and predictive diagnostics that allow asset conditions and actionable insight to be accurately and clearly communicated to users.

The system uses specially developed analytical models and data logged-in intelligent actuators to allow users to effectively plan maintenance and react appropriately to developing issues. This leads to reduced costs, reduced risk to the plant and increased uptime.

Conclusion

With the growing demand for LNG, these processes require accurate and effective flow management that can operate in difficult conditions and minimise total emissions across the supply chain.

The LNG business is intricate, but with effective and dependable flow control assets like actuators, it is possible to produce, transport, and distribute LNG in a way that is safe, efficient, and reliable.

When the asset's whole life cycle is taken into consideration, a system is future-proofed. It decreases the risk of failure, removes the need to modify existing connections or control systems, and increases its ability to continue running. More customers than ever have access to intelligent flow control solutions, and by taking advantage of the right plan, they can increase the profits, uptime, and safety of their sites whilst reducing costs and environmental impact. 

References

1. FULWOOD, M., 'A New Global Gas Order? (Part 1): The Outlook to 2030 after the Energy Crisis', The Oxford Institute for Energy Studies, p. 3, (July 2023).
2. 'World Energy Investment 2023', International Energy Agency, p. 15, (May 2023).