A mindset shift in operating safe, reliable and profitable ageing assets.

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Global energy demand relies heavily on oil and gas, with over 70% of production stemming from ageing infrastructure, often decades old and nearing economic limits (Parker, 2023). As the energy sector transitions to a cleaner future, maintaining the operational integrity of these assets is crucial. However, a common misconception persists that older infrastructure is inherently less reliable, costlier, and less efficient. This mindset, associating ageing assets with diminishing returns, must be challenged. Older assets often possess simpler, more robust equipment and benefit from extensive performance history, enabling highly effective maintenance strategies.

This study explores how oil and gas operators can leverage these inherent advantages to ensure the safe, reliable, and profitable operation of ageing assets. By implementing a framework encompassing strategic asset management, preventative maintenance, and continuous improvement, the industry can overcome the challenges of ageing infrastructure and transform it into a competitive advantage. An integrated approach to asset integrity and reliability enables life extension, cost reduction, and optimised production, all while prioritising safety and sustainability.

The Challenges of Ageing Oil and Gas Infrastructure

Ageing oil and gas infrastructure, particularly in the upstream and midstream sectors, presents several key challenges. These assets, often decades old, become increasingly susceptible to wear and tear, demanding more frequent maintenance and eventually replacement. These challenges include:

1. **Escalating Costs:** Older equipment requires more frequent maintenance and repairs, driving up operational expenses. Finding replacement parts, particularly obsolete ones, can further inflate costs.
2. **Declining Performance:** The efficiency and reliability of older equipment often diminish over time, leading to reduced output or increased downtime. This can significantly impact production, especially in a sector with tight margins and growing competition.
3. **Heightened Safety Risks:** Ageing increases the risk of equipment failures, posing safety hazards to personnel, the environment, and surrounding communities. Corrosion, wear, and fatigue require diligent monitoring to prevent catastrophic accidents.
4. **Evolving Regulatory Landscape:** Meeting increasingly stringent environmental and safety regulations can be challenging for ageing infrastructure, potentially requiring costly upgrades or replacements.
5. **Integration Barriers:** Integrating modern digital technologies and automation systems with legacy infrastructure can be complex due to compatibility issues, hindering production optimisation and operational efficiency.

Despite these challenges, mature infrastructure remains a vital component of global energy supply. With strategic management, these assets will continue to generate significant value.

Reframing the Narrative: The Value of Ageing Infrastructure

The Oil and gas industry often mistakenly equates ageing assets with unreliability, inefficiency, and excessive cost. This counterproductive mindset can become a self-fulfilling prophecy. Age alone does not dictate deterioration or safety risks. In fact, older infrastructure offers several key advantages for optimising operations:

1. **Simplicity and Robustness:** Older assets often feature simpler, and more robust designs compared to modern systems, which can incorporate more complex and delicate components. This simplicity translates to easier operation and fewer potential failure points, often making established infrastructure more reliable and easier to maintain.
2. **Extensive Performance History:** A significant advantage of ageing infrastructure is the wealth of historical performance data. Decades of operational records enable predictive maintenance strategies. Analysing past performance and failures allows operators to anticipate future issues, optimise maintenance schedules, and extend the life of critical components, reducing unplanned downtime.
3. **Cost-Effective Modernisation:** Targeted retrofits of older assets with newer technologies (e.g. sensors, digital monitoring, automated controls) can be more cost-effective than full system replacement. These upgrades can enhance efficiency and reliability without substantial capital expenditure of complete replacement.
4. **Demonstrated Reliability:** Decades of operation often demonstrate the inherent reliability of legacy infrastructure, which may have already undergone significant improvements. Regular maintenance and timely upgrades ensure continued safe operation and can extend asset life well beyond initial expectations.

To address the challenges and capitalise on the advantages of aged assets, dss+ developed an integrated asset integrity and reliability framework. This comprehensive strategy encompasses risk management, maintenance, safety, and continuous improvement, providing a structured approach to maximising the value of mature infrastructure. Key components of this framework include:

1. **Safety and Production-Critical Equipment Strategies:** Identifying critical equipment and implementing tailored inspection programs are essential for mitigating risks and ensuring production continuity. Strategies involve enhanced corrosion monitoring, structural integrity assessments, and advanced diagnostics to proactively detect potential failures.
2. **Asset Life Extension Risk Assessments:** Crucial for determining the remaining useful life of ageing assets and identifying associated risks, risk-based assessments inform decisions regarding upgrades or replacements and guide strategies for safely extending the life of key assets. These assessments consider the asset's current condition, operational environment, and potential failure modes, enabling prioritised maintenance and efficient resource allocation. This is particularly relevant for upstream assets, where well-life and production profiles directly impact lifecycle and extension assessments.
3. **Optimised Maintenance and Reliability Processes:** Effective maintenance is crucial for the safe and reliable operation of mature assets. Predictive and preventative maintenance strategies, combined with robust monitoring systems, can identify and resolve potential issues before costly failures occur. Integrated with the broader asset management framework, these processes ensure regular assessment, maintenance, and repair, minimising unplanned downtime.
4. **Turnaround Optimisation:** Turnarounds—scheduled shutdowns for maintenance or upgrades—are essential for legacy infrastructure. Optimising turnaround efficiency is key to minimising downtime and reducing costs. Best practices include meticulous planning, execution, and coordination, with a strong focus on scheduling, procurement, workforce management, and safety.
5. **Continuous Improvement in Asset Management:** Continuous improvement is vital for maintaining the competitiveness and optimising the performance of ageing infrastructure. Regularly reviewing asset performance, evaluating new technologies, and incorporating lessons learned enhance maintenance strategies and operational processes. This iterative approach enables operators to identify areas for improvement and maximise the value of older assets.

Illustrative Examples

Several examples demonstrate the impact of applying an integrated asset integrity and reliability framework. For instance, at a mature oil refinery, this approach resulted in a 50% reduction in corrective maintenance, improved mean time between failure on critical equipment, enhanced operational stability and reduced unplanned shutdowns, leading to increased revenue. At a large petrochemical site, a similar implementation achieved a 20% reduction in maintenance spending, a 100% improvement in schedule compliance improvement, and 50% maintenance backlog.

Conclusion

Mature oil and gas infrastructure plays a crucial role in meeting global energy demands during the energy transition. While these assets present challenges related to maintenance, safety, and efficiency, they also offer advantages such as simplicity, robustness, and extensive performance history. An integrated asset integrity and reliability framework enables operators to optimise the performance of legacy infrastructure, ensuring its safe, reliable, and profitable operation. Challenging the misconception of ageing assets as inherently unreliable and costly is essential. A proactive, strategic approach, embodied by the dss+ framework, is necessary to extend asset life, mitigate operational risks, and ensure the continued viability of these critical assets during the global energy transition.

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About dss+

dss+ is the operational transformation partner for complex and high-hazard industries. Driven by our purpose, we help organisations achieve breakthroughs in safety, performance and sustainability that build business endurance and ensure long-term success. We engage deeply within organisations to empower teams to shift mindsets, shape cultures, and establish the capabilities required at every level. We combine technical expertise and operational experience with a people-centered approach and data-driven insight.

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