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Predicts 2024: Oil and Gas — Traditional Value Chains and Transformed Operations

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Initiatives: Energy and Utilities Digital Transformation and Innovation

Oil and gas companies are refocused on traditional value chains, and digital transformation efforts show technology is essential for future operational excellence. To prepare for growing tension between old and new notions for exploiting technology, CIOs can use this research to align strategies.

Overview

Key Findings

- The interplay of economic, market and geopolitical forces continues to make business conditions volatile for oil and gas companies; however, they are adapting. In particular, companies are making clearer strategic bets on where to place capital investment.
- In most likely scenarios, oil and gas remain major contributors to the global energy mix until the middle of the century. Demand is likely to soften and decline gradually, climate goals and electric vehicle adoption notwithstanding.
- Oil and gas companies have found it hard to generate returns from cleaner energy generation that are comparable to those from oil and gas.
- These trends, underscored by the actions of some major players, point toward a refocus on oil and gas value chains in the longer term.
- Global energy systems will continue to transform into networked distributed energy systems, replacing formerly linear energy flows, impacting operating models and requiring greater responsiveness, adaptability and orchestration across the value chain. Technology will be essential in enabling new capabilities that oil and gas companies need to thrive now and beyond the energy transition.

Recommendations

- Establish clear strategic targets inspired by the predictions in this and Gartner's oil and gas trends research as endpoints toward which to formulate technology strategies.
- Move beyond delivering multiple disparate streams of digital initiatives to create a coherent roadmap of digital programs that are clearly aligned to the strategic targets set.
- Update and modernize digital foundations with a coherent architecture and essential technologies to enable the aligned roadmap.

Strategic Planning Assumptions

- Now through 2026, industry investment supporting the traditional hydrocarbon value chain will grow faster than investment in low-carbon energies, prioritizing profitability at the expense of environmental goals.
- By 2028, more than 50% of oil and gas companies will modernize their strategy for operational excellence by making intelligent assets the primary objective of digital investment.
- By 2027, vendor-sourced platform solutions will be so effective they will be preferred over internally developed platforms by 60% of oil and gas companies.
- By 2026, generative AI will unlock radical productivity gains for 30% of oil and gas companies by providing low-friction pathways for silo-spanning collaboration.

Analysis

What You Need to Know

Hydrocarbons remain in high demand and generating comparable returns from alternative energies is very difficult. While still a topic of intense debate, the timing and rate of decline in hydrocarbon demand seem increasingly unlikely to conform to aggressive net zero scenarios. In addition, in some developed economies, there are louder voices expressing public and political opinions that push back against the hard reality of energy transition choices.

Environmental performance will still continue to elevate in priority. Companies will continue to decarbonize oil and gas operations, and to invest alternatively. However, for oil and gas companies, the pace and scale of transition away from fossil fuels will moderate.

At the same time, change in wider energy systems will accelerate. Outside oil and gas, energy generation and consumption systems and the consumer environment will transform. Energy generation will become a distributed ecosystem of participants and will be more localized. Oil and gas will need to compete in a much more integrated and dynamic energy system — one that involves a tightly coupled ecosystem of companies and facilities that are both consumers and producers of energy. Operational practices and operational excellence will need to keep pace, shifting to machine-driven processes and intelligent assets.

CIOs and digital leaders face big choices about where to focus. Along with a renewed emphasis on established hydrocarbon value chains will come pressure from stakeholders to maintain traditional operating models and technology strategies. CIOs may be asked to arbitrate as different stakeholders press for old or new approaches.

We think reversion to the status quo ante will be a mistake. Even if operating models transform slowly, companies will still need to continue to improve efficiency and manage costs. Capabilities such as decision intelligence, seamless automation and software-defined assets will achieve these results, as well as enabling future operating models (see Can Operations Be Excellent Without Intelligent Industrial Assets?).

Leading oil and gas companies will press ahead with coherent digital strategies designed to transform operations with intelligent operations as the strategic guiding principle. These companies will be ideally positioned for agility, resilience and adaptability in the transforming energy ecosystem.

Strategic Planning Assumptions

Strategic Planning Assumption: Now through 2026, industry investment supporting the traditional hydrocarbon value chain will grow faster than investment in low-carbon energies, prioritizing profitability at the expense of environmental goals.

Analysis by: Simon Cushing

Key Findings:

- Major oil and gas company stances show evidence of hardening around a view that oil demand will continue to rise until near the end of this decade, falling only slowly over the next 20 years. This will maintain a significant oil and gas sector and give companies time to hone competitive strategies in a declining market.
- Oil and gas companies have struggled to gain satisfactory returns from renewable and other energy businesses compared to historical returns from hydrocarbon value chains.
- Companies will successfully generate returns through capital efficiency, operational excellence and strategic focus on advantaged portfolios. Investment priorities will shift back toward hydrocarbon value chains and renewables investment will slow.

Market Implications:

Despite the global climate goal-driven impetus to move away from fossil fuels, oil and gas demand continues to rise. The U.S. Energy Information Administration (EIA) projects that oil consumption will reach 101 million barrels per day at the end of 2023, a historical high. The EIA currently forecasts annual growth of around 2% through 2024, in line with recent norms.

While renewable energy is growing rapidly, its total share of energy production remains very small, at less than 6% according to the International Energy Agency (IEA). The IEA reports that the global renewables supply needs to grow by around 13% per year to achieve net zero. Current supply addition rates fall well short of this. [1]

Further policy intervention will likely spur renewables acceleration, especially in the developed world and China. But the task of displacing fossil fuels is still enormous. Global research and consultancy group Wood Mackenzie expects oil demand to continue to grow until the end of the decade, and fall only slowly as far out as 2050. [2] Much uncertainty remains, but scenarios with rapid and near-term decline in demand for oil in particular appear increasingly unlikely.

Uncertainty about the energy transition has made capital allocation planning tricky for oil and gas companies. However, the volatility and uncertainty of recent years have reinforced capital discipline and driven continued efficiency gains in oil and gas operations. Companies have struggled to gain comparable returns from their investments in renewable energy businesses.

Significant investment in exploration and production is required to meet this continued fossil fuel demand as fields decline and reserves are produced. While the balance of risk factors is uncertain, Wood MacKenzie assesses a good chance of the required investment being made.

Notably in 2023, some major oil and gas companies publicly softened their ambitions for future business shifts away from oil and gas. [3] This is a significant trend. We expect the industry as a whole to be more bullish about the continuing place of fossil fuels in the 21st century energy mix, and to double down on oil and gas projects over the next few years.

Recommendations:

- Modernize legacy systems to deliver higher efficiency and cost-effectiveness in traditional workflows.
- Create alignment around decision intelligence, seamless automation and digital-physical asset designs as lighthouses to direct technology strategy.
- Invest in digital twins, cloud, AI, cyber-physical security, automation and autonomous commercial transactions to support future new operating models driven by energy system evolution.

Related Research:

Can Operations Be Excellent Without Intelligent Industrial Assets?

Quick Answer: What Key Practices Can Ensure Successful Digital Strategy Execution in Oil and Gas?

Strategic Planning Assumption: By 2028, more than 50% of oil and gas companies will modernize their strategy for operational excellence by making intelligent assets the primary objective of digital investment.

Analysis by: Rich McAvey

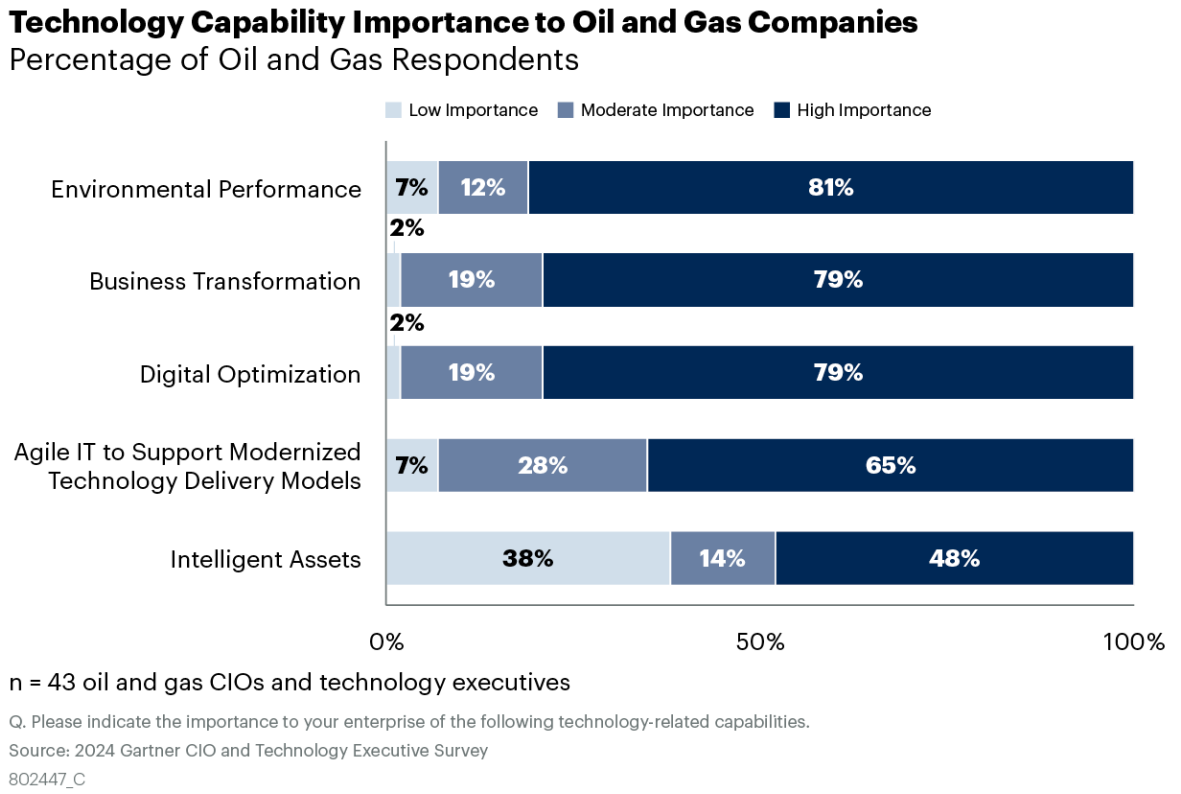
Key Findings:

- The structure of energy markets is changing from unidirectional flows within stable, isolated commodity channels to dynamic, multidirectional flow across commodity channels. [4]
- The portfolios of oil and gas companies are expanding to include limited, but significant, investments in alternative energy products and services. The operating models for these new business ventures are leaner, more adaptable and more integrated than oil and gas.
- To improve the efficiency of traditional and new business lines, industry leaders are rethinking their approach for creating operating intelligence and are developing new enterprise capabilities based on decision intelligence and seamless automation.
- The fragmented designs of traditional oil and gas assets are inhibiting progress. [5] Industry leaders are expanding the scope of their digital investment portfolios to develop new asset design models that tightly integrate advanced cyber and physical technologies.

Market Implications:

In recent years, oil and gas companies have been buffeted by volatile markets and geopolitical complexity. The initial response for most companies was to narrow their portfolio of operations to assets with the best current cash flows. As Figure 1 shows, the strategic priorities for over 90% of oil and gas companies are focused on improving the operational excellence of traditional business models via environmental performance, business transformation, digital optimization and IT agility.

Figure 1: Strategic Technology Priorities for Oil and Gas Companies



However, ongoing uncertainty about the timing of energy transition is also making it challenging to appropriately allocate strategic capital between traditional oil and gas assets (to further improve operations or acquire new portfolios) and alternative energy assets (such as hydrogen and carbon capture). Current market outlooks suggest that traditional oil and gas investments will coexist with alternative energy investments in oil and gas asset portfolios for decades to come. Although every company's approach is different, two patterns for strategic investment have emerged:

- Strategy No. 1: Monitor new opportunities but invest exclusively in traditional operations (via technology investment and opportunistic acquisitions).
- Strategy No. 2: Balance strategic investments thoughtfully and dynamically across traditional and alternative energy opportunities.

Over time, companies pursuing Strategy No. 2 discover and add another item to their list of strategic technology priorities. They learn that traditional oil and gas business platforms are not well-suited to the need for integrated decision intelligence and seamless automation in alternative business models.

They also observe that traditional digital investments struggle to deliver their basic ROI promises and are doing little to create an operating model suitable for energy business. Upon examination, leaders adhering to Strategy No. 2 have discovered that the disjointed and inflexible technology stack of traditional oil and gas assets is the root cause of the problems. This realization sparks interest in new designs for intelligent assets that offer distinctive capabilities, such as simultaneous objective optimization, low-friction adaptability, exceedingly high efficiency and flexible life cycle asset enhancement.

Following the downturn created by the COVID-19 pandemic, interest in understanding the potential for intelligent assets has grown from zero to over 50%, as illustrated in Figure 1. While interest is high and growing, there are many challenges to developing an effective intelligent asset strategy. The concept is still new, and there is still much ambiguity among business leaders over the appropriate intelligent asset strategy for their company.

The first step must be to develop sufficient leadership expertise so that potential investment options can be realistically analyzed and consensus is reached for a company-specific strategy. As the company's ambition for intelligent assets becomes clear, executives must then recognize that every intelligent asset strategy is emerging in the midst of an already crowded program of digital projects. Existing digital investment roadmaps must be leveraged fully to minimize the incremental investment requirements for intelligent assets. CIOs are well-positioned to play important leadership roles in facilitating the formation of an intelligent asset strategy and orchestrating integration among digital products to ease the path forward.

Recommendations:

- Start an internal dialogue among business and technology leaders to build sufficient competency to allow objective evaluations of potential intelligent asset investments and create consensus for the optimal intelligent asset ambition for your company.
- Improve leverage across the entire enterprise portfolio of digital investment by creating a comprehensive view of all digital roadmaps. Use generative AI to make this view easy to understand. Actively orchestrate project integration and consolidation to improve effectiveness.
- Inspire commitment to execute the strategy. Unlock potential via a communications campaign to engage employees and external partners, and build commitment and momentum.

Related Research:

To Enable Intelligent Industrial Assets, Strengthen These Digital Capabilities

Strategic Planning Assumption: By 2027, vendor-sourced platform solutions will be so effective they will be preferred over internally developed platforms by 60% of oil and gas companies.

Analysis by: Rich McAvey

Key Findings:

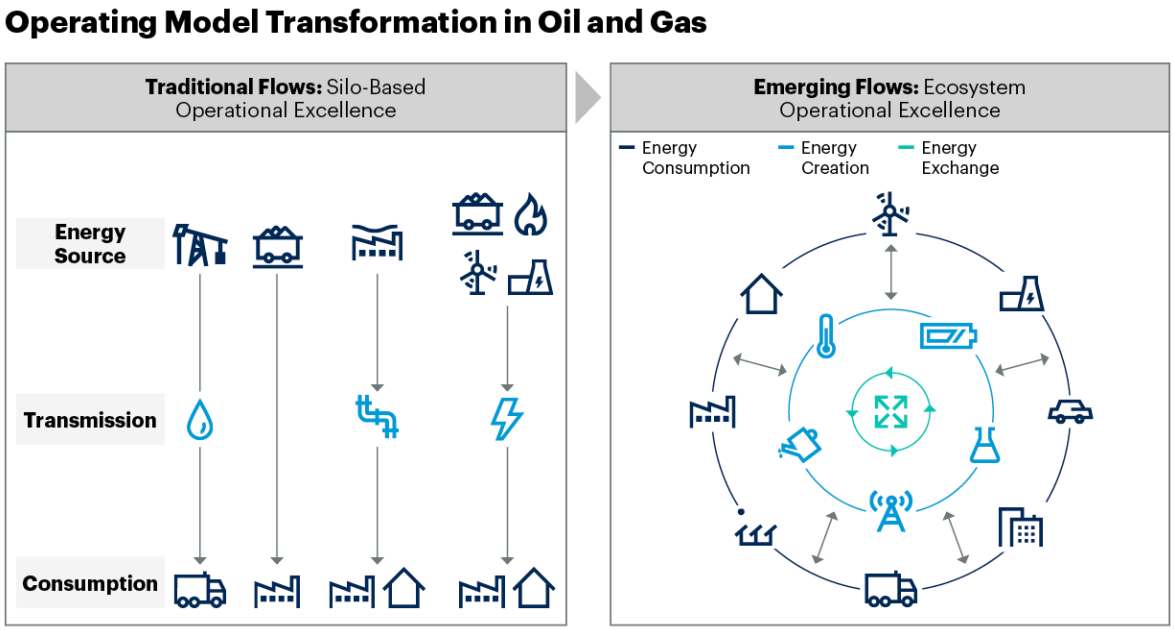
- Industry-spanning operating platforms historically have taken decades to evolve (for example, ERP and enterprise asset management).
- New platforms to enable enhanced agile operating models are urgently needed. However, progress is slow due to oil and gas companies' internal organizational issues, not technology challenges.
- Vendors of multiclient, comprehensive multifunctional platforms are making faster progress. Consolidating, integrating and simplifying operational workflows in a vendor-based platform is becoming a popular strategy for making large-scale improvements the the core technology stack of oil and gas companies.

Market Implications:

Transformation of energy markets is universally agreed on, but differently envisioned by energy companies. For some, energy transformation means strong demand growth (as the next billion people come out of poverty) coupled with sustained environmental impact (from higher levels of fossil fuels). For others, energy transformation means an unprecedented opportunity to invest in new revenue streams (such as hydrogen, offshore wind and carbon capture). However, there is growing awareness of an even more powerful implication of energy transformation.

As Figure 2 illustrates, regardless of commodity or environmental implication, there will be an industry-level shift in energy flows. The historical pattern of unidirectional energy flow through stable, isolated hydrocarbon value chains (for example, oil production through liquid pipelines to refineries) will fade. A new pattern of multidirectional energy flows through dynamically interconnected energy assets will increase (for example, integrated networks of renewable, gas, and carbon capture assets). This shift will make today's best operating models obsolete in 10 years, even for companies that do not alter the composition of their energy assets. [6]

Figure 2: Operating Model Transformation in Oil and Gas



Source: Adapted From EU Energy System Integration Strategy, European Commission
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Consequently, oil and gas companies will need a new business operating platform to sustain competitive levels of operational excellence as time progresses. While each company builds its own business model, the characteristics of the technology stack animating each model will be similar. Data will be universally accessible to AI-powered processes and digital twin modeling. Computing resources will be housed in composable platforms that can be easily updated and reconfigured. Workflows will be seamlessly integrated across business functions (for example, engineering, operations and maintenance) and value chains (for example, energy producers, transporters, and product/service delivery). Technologies will be integrated from cloud to edge locations with zero trust methodology and architecture.

Although the future vision for operational excellence has become clear, the means to achieve it are obscure and progress is slow. The top barriers to creating a new operating model in oil and gas are organizational, not technical. Consequently, operators are shifting their focus away from internal platform development to co-development of future operating platforms with strategic technology partners.

Vendors of multiclient, multifunction platforms typically use a technology stack that is well-suited to oil and gas needs. They centralize data with a proprietary model that is hidden from users behind a wall of APIs/context. They map client's existing data into their commodity model where they can use standard data management methods to maintain it. They can then build SaaS-based business solutions that can easily be configured to interface with the remaining legacy systems in each client.

Evidence that this approach enables faster and more manageable migration to superior operating platforms is growing in several oil and gas domains, including:

- Cloud-based data integration and analytics platforms provided by hyperscalers such as Microsoft Azure and Amazon Web Services (AWS)
- Geoscience data migration to OSDU and workflow simplification in petrotechnical clouds such as those from SLB and Halliburton
- Cloud-based OT data management and analysis from firms such as Cognite, and SaaS consolidated workflow suites from Siemens and Honeywell

CIOs can develop more direct paths toward enterprise platform consolidation by integrating appropriate vendor platforms into their digital strategies. These vendor-specific "industry platforms" provide a consistent landing spot for migrating data and work from individual business units even though they make the transition over time. In addition, engaging in co-development partnerships with these vendors gives a company influence over the development pathways of these platforms.

Recommendations:

- Analyze the market and develop a radar for vendor platforms that hold the highest potential for realistically consolidating and simplifying data management and work consolidation for your firm.
- Educate business leaders on the opportunity and develop a shared strategy for leveraging selected platforms as landing points for projects that transform operations.
- Establish appropriate relationships with industry-leading vendors early and leverage their resources to educate your business leaders and develop peer company contacts.

Related Research:

Hype Cycle for Oil and Gas, 2023

Tool: Gartner Essential Frameworks for Energy and Utilities

Strategic Planning Assumption: By 2026, generative AI will unlock radical productivity gains for 30% of oil and gas companies by providing low-friction pathways for silo-spanning collaboration.

Analysis by: Simon Cushing

Key Findings:

- New energy ecosystems will drive operating models that require flexible and collaborative workflows that cross traditional oil and gas organizational and functional boundaries.
- Technology solutions that enable flexible, silo-spanning workflows can address long-standing process bottlenecks in oil and gas companies and will quickly gain traction.
- In combination with other AI tools for managing explicit knowledge, GenAI shows early promise as a facilitator for next-generation workflows.

Market Implications:

As the energy transition proceeds, energy provision will shift to take place in highly interconnected ecosystems of companies and energy facilities. For energy companies, this means new operating models. Changes — planned or unplanned — that affect one part of operations will impact other parts of the business more widely and rapidly. Today's siloed operating models are not flexible or responsive enough to cope. Oil and gas companies will need silo-spanning workflows for flexibility and responsiveness, Decision points will be more flexible, moving toward workflows that assemble for the needs of the moment, rather than being rigidly encoded in organizational hierarchies or structures.

In combination with AI and other technologies enabling metadata-rich and context-aware enterprise knowledge resources, generative AI shows potential as a tool to support highly collaborative work across silos by delivering custom-configured workspaces and populating them with highly relevant, easily consumable information. This combination will work to guide decision makers through the process, serving up the tools and information needed for the next steps or decisions at the point of need.

Widespread use of these tools is set to turbocharge worker productivity by facilitating easy collaboration and eliminating time-consuming data assembly and conditioning within workflows. Additionally, it can improve decisions with curated information from across the whole enterprise information corpus. Oil and gas companies have long struggled to remove the friction from business processes where they cross organizational boundaries, and to improve access to the whole enterprise body of captured knowledge.

Companies that master this new technology niche are likely to see strong productivity gains that will add significant momentum for further adoption of the enabling technology.

Recommendations:

- Start now to comprehensively identify and track emerging silo-spanning generative AI workflow enhancement solutions.
- Identify high-friction or bottleneck cross-functional workflows that emerging solutions could address.
- Use specific proofs of concept to work with generative AI teams and vendors to gain an understanding of key capabilities and accelerate product development roadmaps to achieve them.

Related Research:

Quick Answer: What to Expect When Expecting Generative AI in Oil and Gas

Use-Case Prism: Generative AI for Energy and Utilities

A Look Back

In response to your requests, we are taking a look back at some key predictions from previous years. We have intentionally selected predictions from opposite ends of the scale — one where we were wholly or largely on target, as well as one we missed.

Missed: 2020 Prediction — By 2022, inappropriate reliance on artificial intelligence (AI) will contribute to at least one major oil and gas industry environmental, health and safety incident or regulatory breach.

This 2020 prediction was based on rapidly rising AI adoption rates and investment plans among oil and gas companies. It has been and remains a high priority for new investment. As AI becomes widespread and embedded in many more enterprise systems, more business decisions are informed by AI outputs. To date, however, AI has not been publicly implicated in any major environmental, health and safety incident or breach. While proliferating, oil and gas AI use cases remain relatively narrow in scope and focused on operational improvement. Critical business decisions or interventions do not yet rely heavily on AI as part of the critical path.

Nevertheless, the warning implied in this prediction remains relevant. As operations become more integrated and complex, AI will continue to become more embedded in workflows and decision making. The rise of generative AI reinforces the need for governance and risk management. Its usefulness could lead to rapid spread, meaning a quick shift to reliance on AI-generated outputs in critical decisions. Oil and gas companies cannot be complacent about AI, and the possibility of its contribution to an incident remains real without appropriate governance and control.

Evidence

[1] Renewables, IEA.

[2] Doing More With Less: Is There Enough Upstream Investment?, Wood MacKenzie September 2023 webinar.

[3] Big Oil's Green Retreat Helps Clear the Way for Everyone Else in Renewables, Bloomberg.

[4] EU Strategy on Energy System Integration, European Commission.

[5] Moving Upstream With Digital Technology in the Oil and Gas Industry, World Oil.

[6] Press Factsheet on EU Energy System Integration Strategy, European Commission.

Recommended by the Authors

Some documents may not be available as part of your current Gartner subscription.

Can Operations Be Excellent Without Intelligent Industrial Assets?

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Hype Cycle for Oil and Gas, 2023

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