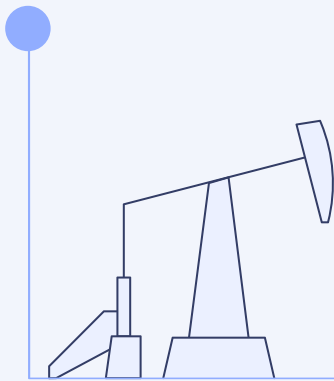
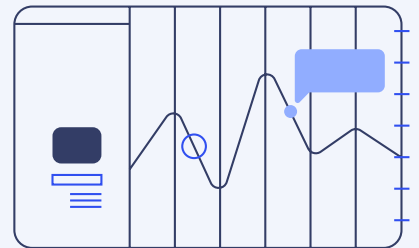
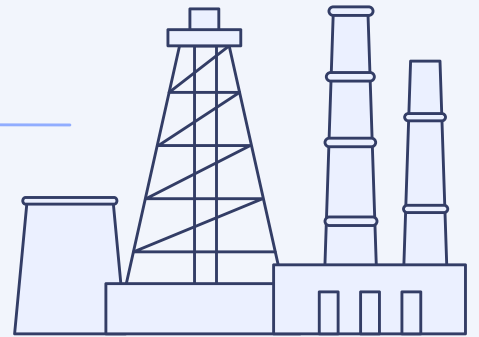


From Fragmented Data to Informed Decisions

Transforming Oil and Gas with AI-Augmented Energy Analytics



Today's oil and gas operators face an unprecedented level of risk. Growing geopolitical instability, increasingly complex operating environments, and a combination of fierce demand and competition mean industry leaders must be able to make operational decisions that optimize output and drive investment.

But at the same time, many operate in a vastly fragmented data landscape. Crucial data sits siloed between functions and tools, and decision-making is slowed or skewed by a lack of timely, accurate insights.

To navigate these twin challenges—rising risk and the need for faster, more informed decisions—operators must have access to tools that allow them to work with heterogeneous technical data across the subsurface, production, operational, and economic domains. They need tools that inform confident decision-making as complexity grows.

In this ebook, we explore the role of a dedicated **visual industrial analytics platform for unifying disparate data, helping teams to extract insights across disciplines and business units, and empowering teams with AI-assisted decision-making capabilities**. We show how this approach helps solve key energy operational challenges, and how that foundation translates into a measurable competitive advantage in an increasingly volatile global market.

Risky business: Challenges in oil and gas operations

The energy industry spans a wide range of technical disciplines and plays a prominent role in global geopolitical and economic systems. Its operational complexity is driven by several unique industry characteristics. Specifically, it is defined by four factors:



Long and complex asset lifecycles

Energy operators are aware that the choices they make today will shape operations for years to come. From the first exploration decision to the final decommissioning plan, operators make high-stakes calls at every stage. Yet these decisions must often be made quickly and with limited data.

At best, making the wrong call can lead to lost opportunities. At worst, it can be a catalyst for unprofitable operations and stranded assets. This risk can wipe anything from an estimated \$1 trillion to \$2.3 trillion off the balance sheets of unwary operators in coming years.¹

¹ Stranded fossil-fuel assets translate to major losses for investors in advanced economies (Nature Climate Change, 2022). <https://www.nature.com/articles/s41558-022-01356-y>; Stranding: modelling the UK's exposure to at-risk fossil fuel assets (UKSIF, 2025). <https://uksif.org/policy/stranding-report/>



High capital and operating costs

Compounding the asset lifecycle issue is the fact that the industry is capital-intensive. Investments range from hundreds of millions to billions of dollars. In such an environment, maximizing operational data insights is critical to ensuring smooth operations and the returns that drive investor confidence.

This is especially important in the current landscape, where investors wary of stranded assets are looking for clear answers. The operators who can provide those answers and prove value place themselves far ahead of the competition.



Supply chain disruptions and price fluctuations

The oil and gas industry is also particularly exposed to geopolitical shifts that can disrupt supply chains and reshape global commodity prices. The result is a market that's often volatile—delivering both windfalls and shrinking margins at short notice.

That volatility often forces operators to reprioritize projects, accelerating or delaying developments and shutting in unprofitable wells.

When the ground shifts that quickly, efficiency becomes critical. Data insights that can maximize throughput and optimize recovery are imperative, as is being able to change course when the numbers demand it.

Cutting across all of the challenges listed above is the complexity, heterogeneity and highly technical nature of oil and gas data. The information operators and experts rely on to solve problems spans multiple domains, and collating and interpreting all of that data is a time-intensive task. Without tools to easily navigate, visualize, and interpret this mass of data, the issues outlined here become near-impossible to solve. As a result, engineers and section leaders are left making best-guess decisions, and uncertain whether their solutions are really adding the most value to the business.

Key drivers of inefficient data use

Three main factors underlie inefficient data use:



Fragmented and disconnected data sources

Most technical data (e.g., well logs, seismic data, production data) is scattered across disconnected systems. To make sense of it, teams typically spend a lot of time manually searching for the data, cleaning it, and then visualizing it within specific tools.

The catch is that these tools are usually designed to handle *only that specific subset of data*. Cross-referencing the results of these analyses with insights from other areas remains a challenge. As a result, teams are often unable to work effectively cross-functionally and lack the degree of insight they would have if they could easily export and visualize data from multiple sources within a single view.



Siloed tools

The fragmented data issue stems from different teams using highly specific tools to extract and analyze the data most relevant to them. The geology team investigates and maps geological features in one tool, and may need another for seismic data. Reservoir engineers examine pressure, volume, and temperature in a different application. Downhole telemetry data sits in a separate silo, and so on.

The issue isn't that there are multiple tools; it's that the data from those tools is extracted and analyzed in isolation. So any cross-functional analysis is often limited because integrating datasets, or adapting tools to new workflows, is itself a time-consuming challenge.

In addition, many of these tools function as "black boxes" when the results are passed along to other teams, who may lack a clear indication of how those results were produced. This can make it difficult for one team to understand the significance (and uncertainty) of another's results, or to connect those results to their own datasets.



Poorly planned AI adoption

AI tools hold the promise of solving many of the issues discussed above, allowing teams to:

- quickly access and extract answers from data,
- identify and solve key challenges,
- take a more innovative approach to improving operations, and
- gain market advantage as a result.

Those capabilities are driving rapid AI adoption across industries. But in practice, many teams still struggle to generate real value from AI tools for several reasons:

1. Despite their significant potential, AI systems are often poorly integrated into workflows. This severely restricts their usefulness and leads to failed projects, stalling the broader implementation of AI across organizations. A recent Gartner survey highlights this fact with the prediction that around 40% of agentic AI projects will be canceled by as soon as 2027.² Meanwhile, a 2025 MIT study shows that GenAI more broadly is failing to deliver value to 95% of the organizations using it—and this is as a direct result of poor workflow integration and misalignment with day-to-day operations.³
2. Lack of human oversight and verification remains a core challenge. To add value in an industry as complex as oil and gas, AI must operate within an expert-in-the-loop workflow, where geoscientists and engineers validate outputs using their domain expertise. AI explainability is equally important. Experts need to understand the data and reasoning behind AI recommendations to build trust and make informed decisions.
3. Using AI (and GenAI) comes with both data security and governance risks. To combat this, organizations must have tools designed specifically for enterprise-scale use, and ideally tailored to their industry.
4. Finally, tools must be designed to simplify data access, visualization, and sharing, and should be customizable across use cases to ensure they add real value in complex industries. Not all tools come with the built-in capabilities to visualize industry-specific data, making it an ongoing challenge for operators to fully integrate AI with their operations.

These requirements add an extra layer of complexity to AI deployments for oil and gas, but they also show that the technology has high potential utility for the sector if deployed effectively.

The impact of poor data use

The factors above contribute to predictable outcomes for oil and gas operators and their teams. They mean:

- that each domain still generates its own data, in its own format, at its own cadence, and managed by its own team,
- that datasets stay siloed, and that the analysis each team can perform is bounded by what their slice of the data shows, and that
- AI adoption and use is spread haphazardly across teams, increasing risk and limiting the value and innovations this technology can deliver.

The bigger outcome is that companies are unable to operate with the agility and accuracy needed to innovate in the face of fierce competition. The resulting financial impact can mean the difference between operations that run profitably and those that are hindered for years to come.

² Gartner predicts over 40% of agentic AI projects will be canceled by end of 2027 (Gartner, 2025). <https://www.gartner.com/en/newsroom/press-releases/2025-06-25-gartner-predicts-over-40-percent-of-agentic-ai-projects-will-be-canceled-by-end-of-2027>

³ The GenAI divide: state of AI in business 2025 (Project NANDA, 2025). https://mlq.ai/media/quarterly_decks/v0.1_State_of_AI_in_Business_2025_Report.pdf

From complexity to clarity: The transformative potential of industrial analytics

Tackling the challenges outlined in the preceding sections requires a fundamentally different approach to how data is handled and analyzed—an approach rooted in the idea that data findings should be:

- unified across teams
- visible and comparable across disciplines

This is the core concept behind sector-specific industrial analytics: **Purpose-built analytics platforms that bring data together from specialized, siloed applications into a single environment where it can be viewed, analyzed, shared, and easily understood across disciplines.**

This allows subsurface, production, operations, and economic teams to rapidly align their views and decision-making, based on an accurate assessment of risk and opportunity.

In short, they serve as a **unified workspace that sits on top of specialized oil and gas applications** and allows members of multiple teams to interact with the same datasets and insights, accelerating alignment and decision-making.

At-a-glance: What is industrial analytics and what does it enable?

Industrial analytics refers to data platforms natively designed to meet the core challenges of specific industries. These platforms typically combine AI capabilities, advanced analytics, and industry-specific workflows that allow teams to turn complex, industrial data from multiple sources into actionable, shared intelligence. They are also designed to handle industrial-scale data volumes and the specific file formats and data visualizations used by different domains within a given industry.

In the case of oil and gas, this means the following:

- Data from multiple domains can be aggregated, viewed, compared, and analyzed in a single data environment.
- Teams can easily align on the most important considerations for specific assets or operational decisions.
- Team leaders and operators can cut through the clutter of complex datasets, reaching crucial insights at the speed business demands.

The four pillars of industrial analytics

To be considered a true industrial analytics solution, platforms must meet four criteria:

1

AI augmentation

A core component of efficient data analysis for industry is *fully integrated AI*. This means AI systems must be embedded directly into workflows, solving the value and implementation gap that contributes to the data insights roadblock. Meeting that goal requires:

- context-aware agents within workflows,
- compatibility with large language models (LLMs) of choice already being used across the organization,
- explainable analyses and suggestions for further data exploration, drawing on the knowledge and domain expertise of human experts.

2

Industry-native functionality

Platform functionalities and workflows should be aligned with real operational processes and industry best practices. This includes having industry-specific visualization tools and analytical methods, support for specialized data structures (e.g., for spatial/geospatial context and management of large datasets), and workflows tailored to real-world investigative patterns (e.g., moving from well performance trends to reservoir models to assess production drop-offs).

Teams must also be able to build out custom workflows and tools to meet their exact challenges and needs, according to the unique context of their operations.

3

Integrated analytics

The solution should support visual data exploration *and* advanced analytics in a single environment. To achieve this, engineers and other users should be able to move from visual observation directly to statistical *validation without needing to switch tools*. This requires built-in, industry-relevant statistical and modeling capabilities, along with support for end-to-end analytical workflows.

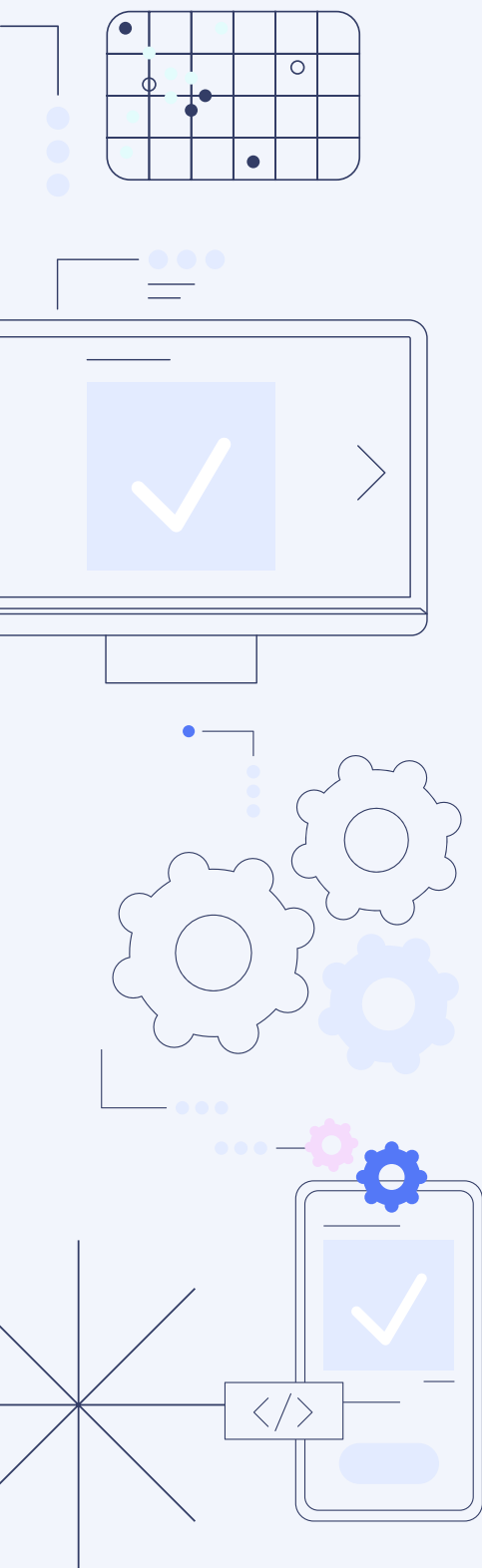


4

Scalable analysis

Platforms should be designed to execute analyses at scale, regardless of dataset size or complexity. This is especially important for energy, where analysis often involves sifting through datasets containing terabytes of data. In practical terms, this capability is supported by push-compute functionality, where data is analyzed in cloud computer clusters, and the results are updated in the shared platform environment.

Together, these four pillars form the foundation of a true industrial analytics platform.



At-a-glance: industrial analytics capabilities for oil and gas

Because industrial analytics platforms are designed to analyze data from multiple disciplines in a single environment, they must be able to function at a *systems level*. In other words, scientists and engineers must be able to both visualize data and the underlying causes of scenarios, across disciplines, in the same environment.

Spotfire® Industry Pro brings this systems-level approach to oil and gas, with industrial analytics capabilities built specifically for subsurface and production workflows. This includes:

- Predictive modeling to quantify risk and sensitivity
- Yield and quantity analysis
- Production optimization models
- Pattern and outlier detection
- Time series analysis
- Time series preprocessing for trend analysis and forecasting
- Reliability analysis
- Industry-specific data visualizations and analyses, like geological mapping and petrophysical analysis

It's also worth noting that as new capabilities and analyses are developed, these can be easily added to existing workflows built in the platform. This keeps teams at the forefront of new developments and evolving best practices.

Upstream use cases for industrial analytics

With the right capabilities in place, analytics platforms can be used across the full spectrum of upstream oil and gas use cases: from asset valuation to ensuring optimal operational efficiency.



Asset valuation

For many teams, asset valuation using traditional tools and software is a slow process, one that leaves decision-makers frustrated when the pace of discovery lags behind that needed to maintain a competitive advantage.

Industrial analytics platforms are designed to speed up this process significantly. By having analyses and visualizations in one environment, teams can rapidly assess the opportunities worth pursuing and prioritizing across acquisitions, divestitures, and reservoir management. They can also quickly pass on suboptimal opportunities, freeing resources to be focused on the most valuable assets.



Field development

Once opportunities have been identified, many teams face an additional challenge: The pace (and efficiency) of field development often depends on data from multiple, disparate sources. But most teams are unable to synthesize that data at the speed needed to prevent later rework.

Using a proper industrial analytics environment, these diverse data streams can be quickly unified. This not only ensures decision-making data is in one place, but it also allows teams to *integrate their analyses and insights* to quickly align on optimal development scenarios, with the trade-offs and upshots clearly quantified.



Production optimization

To optimize production, teams must access a combination of real-time and historical data across wells, facilities, and operating conditions. In many companies, however, that data is siloed, with real-time analytics and historical values housed in different systems. This makes it difficult to track trends and head off issues.

By combining live sensor data and historical records in real time, industrial analytics tools empower teams to monitor these emerging patterns so they can:

- identify potential downtime, constraints, and performance issues *before* they occur,
- optimize production trajectories and asset life cycles proactively, and
- minimize lost production.



Operational excellence

Operational excellence depends on a number of factors: early awareness of risks and potential failures, timely asset maintenance, and proactive reservoir management. Using integrated analytics tools, operators can quickly detect the first signs of behavioral deviations in assets and production flows. This allows them to respond before small issues become larger problems, and to proactively identify the assets most in need of maintenance and workovers.

Integrated datasets also allow operators to establish coordinated responses and stronger workflows across multiple functions, ensuring safer operating conditions and more reliable production.

At-a-glance: the business case for industrial analytics

The unification of data, technical expertise, and visual analytics brings clear benefits for oil and gas operators. In practical terms, it means:

Faster decision-making across fragmented systems

Analytics that connect multiple domains accelerate decision-making for upstream teams. Engineers and scientists can make confident recommendations using data in a single visual layer. And operators can be assured of the accuracy of the data underlying impactful decisions.

Reduced non-productive time

Integrated real-time data exposes deviations and issues early, allowing teams to act before issues escalate. Teams also have a better lead-in to downtime, equipment overhauls, and planned maintenance, so they can schedule these in a way that minimizes production losses.

Improved reservoir understanding

Uniting geologic, engineering, and petrophysical data allows domain experts to quickly validate their insights and predictions about the reservoir. They can also model potential outcomes with improved confidence that those models reflect real scenarios and field behavior.

More reliable forecasting

The support of context-specific AI improves forecasting, with experts refining and validating model assumptions to better reflect real-world conditions. This helps ensure forecasts remain grounded in operational reality, providing more reliable insight into how opportunities should be prioritized and developed, or when assets should be decommissioned.

Industrial analytics in action: How Liberty Energy turned real-time data insights into operational agility

In the following case study, we unpack how one operator, Liberty Energy, used Spotfire's industrial analytics capabilities to improve performance and agility across their operations.



Company context

As one of the largest providers of technology-driven energy solutions in North America and Australia, Liberty Energy is deeply committed to innovation and operational excellence. At the same time, the company is expanding rapidly, which makes handling and analyzing their growing volumes of data a significant challenge.



The challenge

In recent years, Liberty Energy saw a **650% increase in active crews and a 4,000% spike in data volume**. With a legacy system that required daily uploads and emailed reports, the company's ability to use that data for timely decision-making and operational improvement was severely hampered. It also made it difficult for engineers and clients to collaborate in real time, and for Liberty to provide the insights and transparency their clients expected.

Realizing these challenges were impacting performance, Liberty was looking for an industry-specific solution that could also be tailored to their unique context.



The Spotfire solution

Using Spotfire as the core, Liberty developed an internal platform, Atlas, that could meet those needs. The platform allows the Liberty team to ingest, standardize, and process data from multiple disparate sources in near real time, including telemetry across the full spectrum of frac equipment. This has led to:

Increased operational awareness

Continuous streaming empowers the Liberty team to uncover timely insights. Both engineers and clients can now monitor live frac jobs and key metrics, reducing delays, catching anomalies early, and ensuring each job is executed to plan.

More accurate decision-making

Intuitive, customizable data applications allow teams to easily interact with and understand key data. Engineers can explore live telemetry, compare it with historical trends, and make accurate decisions even under changing conditions.

Meanwhile, Liberty's clients can access user-appropriate data views that improve their situational awareness and enhance joint decision-making.

Governance and scalability

Liberty has also been able to easily tailor data access according to user needs: internal users can oversee operations, while external users view only their own data, maintaining transparency and trust without compromising security. At the same time, the system scales easily to changing requirements, allowing Liberty to extend it across use cases and user bases as needed.

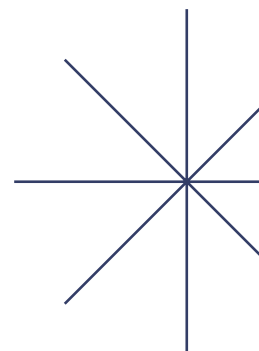
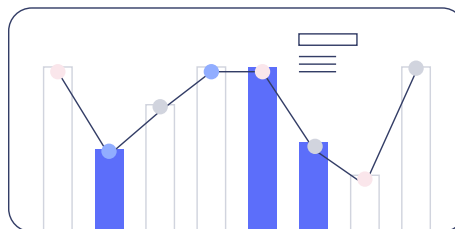
Accelerated innovation

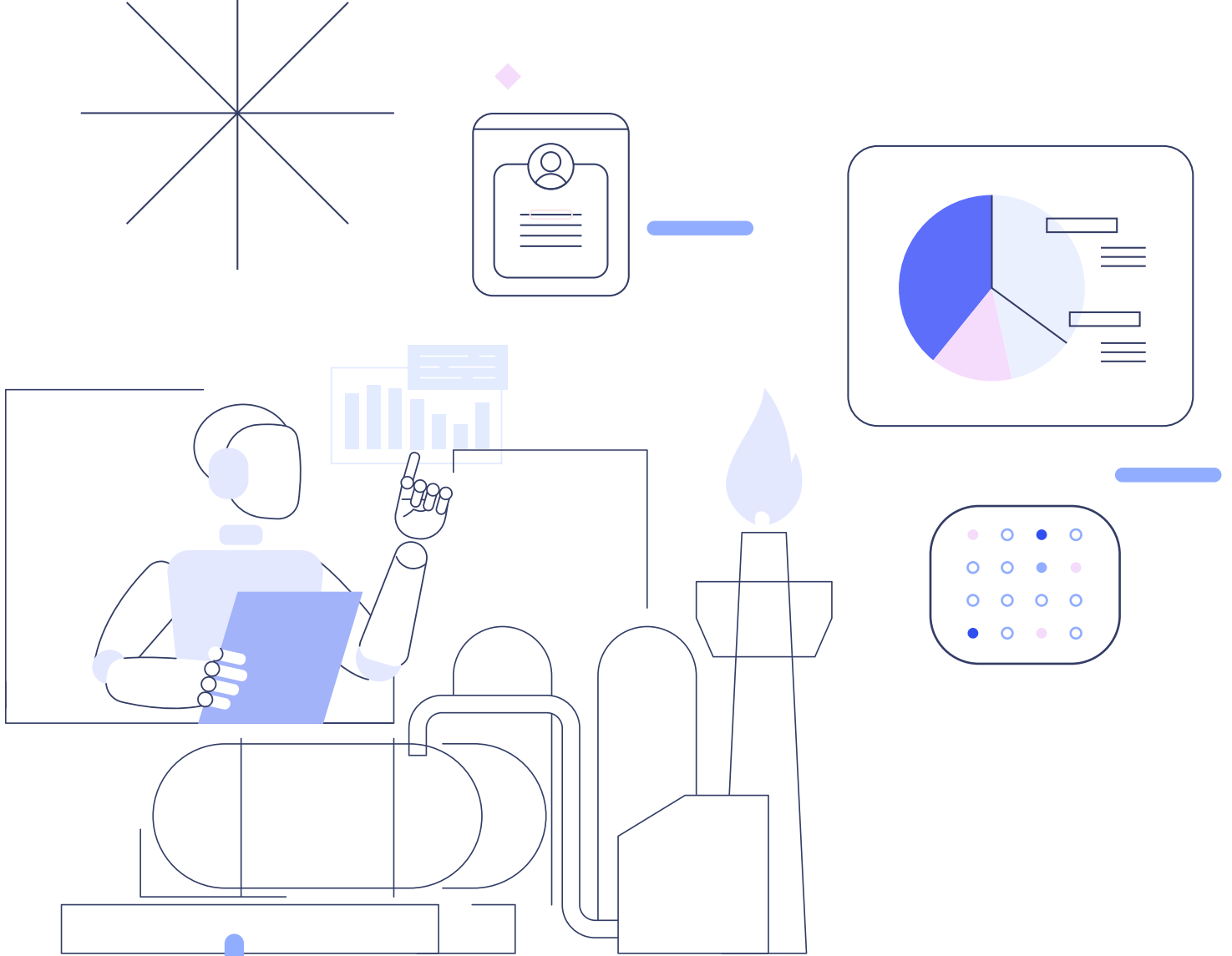
Finally, in an industry where the pace of innovation dictates success, Spotfire's industrial analytics capabilities allow Liberty Energy to quickly adapt to a wide range of new analytics use cases. The team is also actively using Spotfire's AI capabilities to develop new data functions and visualizations, tailored to their changing requirements.



Looking ahead

As Liberty continues to scale and expand adoption of Spotfire across their operations, their sights are fixed firmly on enhancing their internal AI capabilities. They plan to expand the use of Spotfire's built-in natural language capability and to adopt new tools for analyzing their sustainability and logistics.



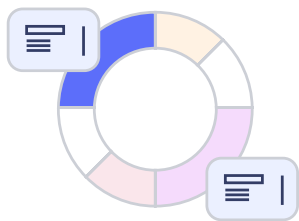


Discover energy analytics with Spotfire

In the years ahead, the complexity and pressure facing energy operators will only intensify. In response, leading oil and gas companies are adopting industrial analytics to turn fragmented data into clear-cut insights, strengthening decision-making and building a competitive advantage that will carry them forward for decades to come.

As the leading industrial analytics solution, Spotfire is proud to partner with these companies, giving them the tools they need to optimize operations across exploration, development, production, and beyond.

Interested in seeing what better analytics can do for your operation? [Learn more.](#)





Spotfire is a visual industrial analytics platform that helps organizations analyze complex operational, engineering, and business data to make better decisions. By combining interactive analytics, AI-assisted investigation, advanced data science, and industry-specific workflows, Spotfire enables domain experts to uncover insights, reduce uncertainty, and improve outcomes across complex industrial operations.

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