

Data-Driven Production Optimization:

Maximize production
with Industrial DataOps and AI



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About Cognite

Cognite is a global industrial SaaS company that supports the full-scale digital transformation of asset-heavy industries around the world. Our core Industrial DataOps platform, **Cognite Data Fusion®**, enables data and domain users to collaborate to quickly and safely develop, operationalize, and scale industrial AI solutions and applications.

Cognite Data Fusion® codifies industrial domain knowledge into software that fits into your existing ecosystem and enables scale from proofs of concepts to truly data-driven operations to deliver both profitability and sustainability.

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Introduction

Few companies have successfully scaled data-driven production optimization. Of the many obstacles they face, one stands out: a lack of accessible, meaningful, and dependable industrial data.

This overarching data problem is holding back the transformation of asset-heavy industries such as oil and gas, power and utilities, and manufacturing, preventing them from optimizing production and cutting emissions.

- Siloed data limits the potential of organizations to understand their past, present, and future.
- Creating new solutions is cumbersome for data and analytics teams and takes too long.
- Successful proofs of concept rarely scale to production, wasting time and money.

- Smaller, stand-alone solutions become new data silos, further complicating digitalization efforts.
- Once a solution is in production, it is hard to maintain and can become untrustworthy to its users.

Industrial data operations (DataOps) can help industrial companies break down their silos and make their data broadly available and usable, and ready to power artificial intelligence (AI) models that—in combination with physics-based modeling and human expertise—optimize production.

Reach your maximum production capacity with Cognite Data Fusion®, the leading Industrial Data-Ops platform.

What is data-driven production optimization?

Production performance managed by context-enriched content, machine learning, and data-based physics models working to increase plant efficiency and optimizing day-to-day production via a holistic, data-driven, and objective view of real-time data across assets.

- Process debottlenecking: Actions to increase production capacity by process debottlenecking.
- Production deferral mitigation: Actions to reduce production deferrals and close the gap between production capacity and actual production.
- Product quality prediction: Actions to identify root causes of potential quality issues during the production process.



Cognite Data Fusion®

The value of industrial data, liberated and contextualized by a new generation of software solutions, is widely recognized. The willingness to share, open, and digest data is catching on across asset-heavy industries. And adopting industrial software, digital tools, robotics, and new, agile ways of work is gaining ground.

The foundation for the necessary, sustainable reinvention of industry is here. Required now, and at scale, are the know-how, the technology, and the tools to transform.

The software to do this transformational work for asset-heavy industries is Cognite Data Fusion®.

Cognite Data Fusion® is an Industrial DataOps platform that facilitates data and AI workflows, giving organizations trusted data to build solutions and applications with speed at scale.

With Cognite Data Fusion®, organizations can achieve record time to value

90%

Less time spent
finding data

50%

Less time spent
making sense of data

10–25x

Faster solution
deployment

[WATCH A WALKTHROUGH OF THE COGNITE DATA FUSION® ARCHITECTURE →](#)

What is Industrial DataOps?

“DataOps is a collaborative data management practice focused on improving the communication, integration, and automation of data flows between data managers and data consumers across an organization.”

Gartner

“DataOps is the ability to enable solutions, develop data products, and activate data for business value across all technology tiers from infrastructure to experience.”

FORRESTER

Cognite Data Fusion®:

→ **Makes industrial data available.** The fastest path to tapping into the value potential of digitalization in industry starts with getting the right data with the right context to the right users at the right time for the right problem.

Cognite Data Fusion® eliminates the time spent on manual data contextualization, offline data discovery, data ingestion, developing a hosting environment, and preparing application data for application consumption.

→ **Makes industrial data usable.** Industrial data becomes truly useful when it is integrated, contextualized, and made securely available, explorable, and actionable to all data consumers—human and machine—within and outside the industrial enterprise. This should encompass all the various sources and formats, including sensor data, process diagrams, 3D models, event histories, asset models, and unstructured documents.

Cognite Data Fusion® enables data and domain users to collaborate to quickly and safely develop, operationalize, and scale industrial AI solutions and applications to production.

→ **Makes industrial data valuable.** Extracting maximum value from data relies on being able to apply advanced models to produce insights that inform

optimal decision-making, empowering operators to take action with confidence. This, in a nutshell, is what is meant by operationalizing data into production for value.

Cognite Data Fusion® codifies industrial domain knowledge into Industrial DataOps software that helps industrial operations draw insights from their data, unlock opportunities in real time, and scale solutions effortlessly.

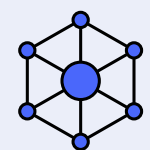
Cognite Data Fusion® at a glance

Asset-heavy industries need to optimize production, improve product quality, and reduce unplanned downtime by generating more value from their data. Cognite Data Fusion® tackles the most difficult industrial data challenges to provide open, contextualized data for organizations.

Industrial data challenges

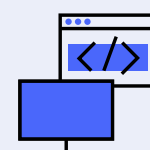
Cognite Data Fusion® provides DataOps at scale for industry, making industrial data accessible, understandable, and useful for data scientists and developers. Cognite Data Fusion® unlocks use cases for industrial data by providing:





Data in context

The machine learning contextualization services in Cognite Data Fusion® create relationships between siloed data such as time series, ERP and work orders, tabular data, IoT logs, events, 3D, and photogrammetry.



Open application architecture

Open standards enable easy integration with widely adopted applications and developer tools.

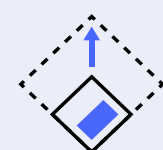
Developer-friendly SDKs and APIs further enhance connectivity.



Known data quality

Manage data quality on a use case basis to ensure recommended actions are valid and trustworthy.

Use prebuilt rules and create new rules with an available logic engine as needed.



Scalable data model

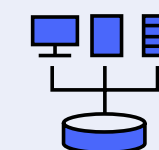
Use templates to scale successful proofs of concept across an entire class of equipment or assets.

Reuse the contextualized data model to solve many use cases from the same model.



Live data access

Combine live operational (OT) data with simulation or historical data to create hybrid AI models that can address use cases in production optimization or quality.



Complete data spectrum

Integrate and contextualize unstructured data to enhance asset and process visibility:

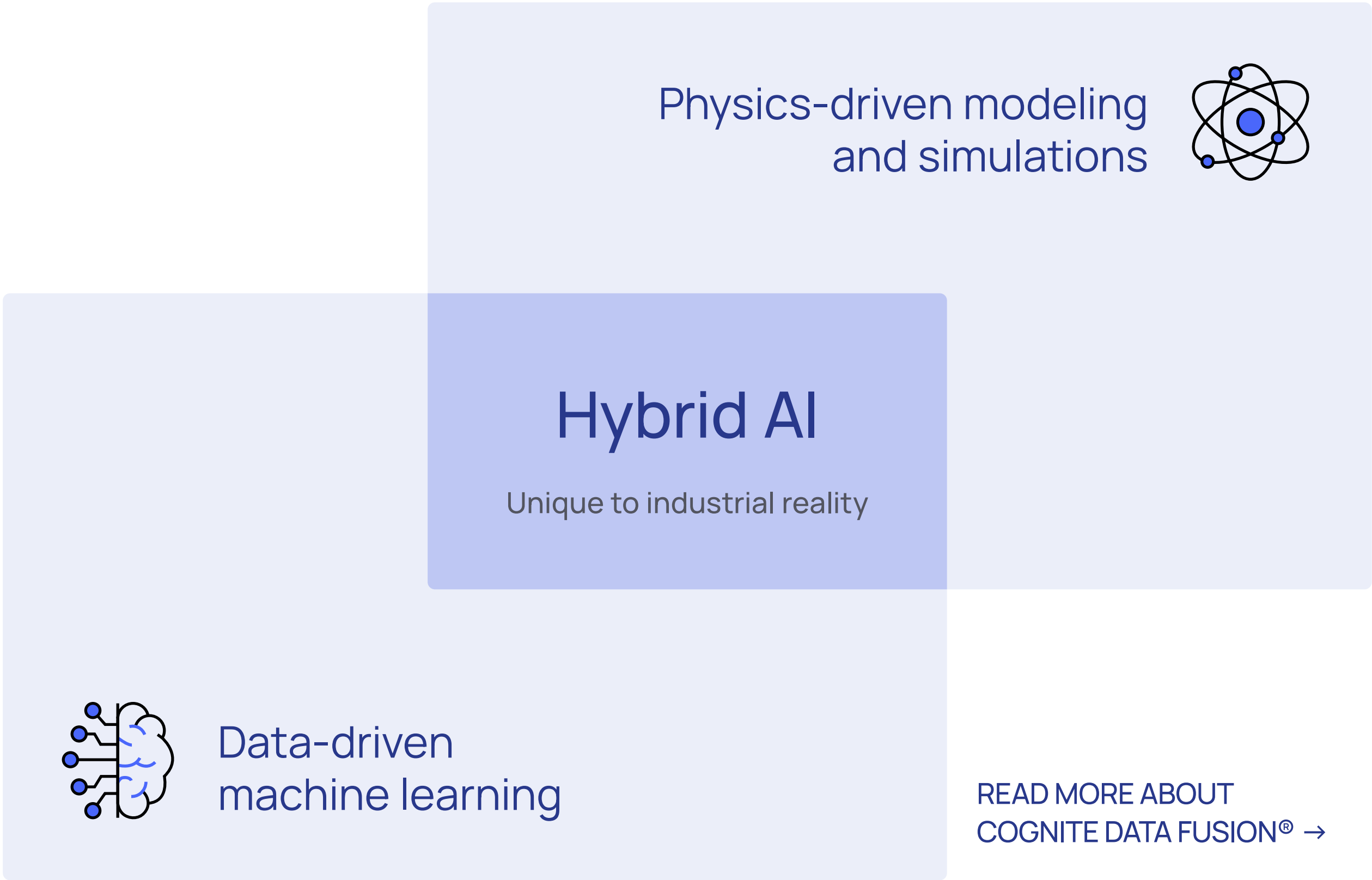
- Robotics to support monitoring and inspection
- Computer vision managing environmental conditions
- Digitize analog signals to support data models

Cognite Data Fusion® benefits:

- Expand the breadth of applications and accelerate development time with a robust data model
- Empower internal development teams with self-service open APIs and SDKs
- Combine your organization's knowledge with Cognite's domain talent and proven partner network
- Democratize embedded subject-matter expertise with data access and contextualization

Cognite Data Fusion® enables hybrid AI

Hybrid AI combines physics-based models and simulations with artificial intelligence to create robust solutions with a high degree of confidence.



└ Cognite's approach to production optimization

Cognite has found that data-driven production optimization use cases tend to fall into three categories. ▶

Turn data into insights

Organizations can achieve instant value by giving teams the chance to visualize their data in its newly enriched context.

While this data has been available somewhere all along, Cognite Data Fusion® brings it together in one place, connected in a way that mirrors the operational reality, and makes it meaningful to those users.

Teams can plug their preferred visualization applications, such as Grafana, Plotly, and Microsoft Power BI, into Cognite Data Fusion® and immediately begin to explore and interpret the information via automated dashboards. **This enables them to make more insightful, qualified decisions based on all the available data.**

As users succeed with these dashboards, they can share them with colleagues and other authorized third parties, both internally and externally where necessary, allowing everyone to understand operations and make decisions based on the same data.

1

Turn data into insights

Visualize existing data and put it into context.

Users interpret information via graphs, dashboards, and more, and make qualified decisions based on available data.

2

Turn insights into actionable advice

Enrich the existing data and create recommendation models with actionable advice.

From single implementations of known equations to anomaly detection and machine learning.

Humans evaluate the output and make qualified decisions based on the recommendations.

3

Automate workflows

Integrate models directly with selected systems to trigger automatic actions.

Closed-loop integrations with operations teams conditionally intervening and responding based on business needs.

Quick visualizations also offer an easy entry point for data science development. Engineers can use visualization and analysis tools to create synthetic time series and test both the data and the system. It doesn't require complex software development or data science training to do complex, offline calculations. Everything is available live in a few clicks.

Turn insights into actionable advice

After straightforward visualization of data, the quickest path to value is the receipt of actionable advice from industrial applications. This is about informing users about the status of their operations and suggesting measures in response. Users bring their own expertise to the table, supplemented by a data-driven overview and the ability to interrogate the data more deeply before taking any action.

By giving experts the ability to evaluate the output and make qualified decisions, organizations realize several benefits: **first**, the empowerment of the employees to do their jobs more precisely based on data and, **second**, the enrichment of the accumulating, living data set based on the data those insightful decisions generate and feed back into Cognite Data Fusion®.

In data-driven production optimization use cases, this could mean common data analytics and statistical methods. It could also mean hybrid AI, which combines the “glass box” interpretability and robust mathematical foundation of physics-based modeling with the pattern recognition and capability and scalability of machine learning.

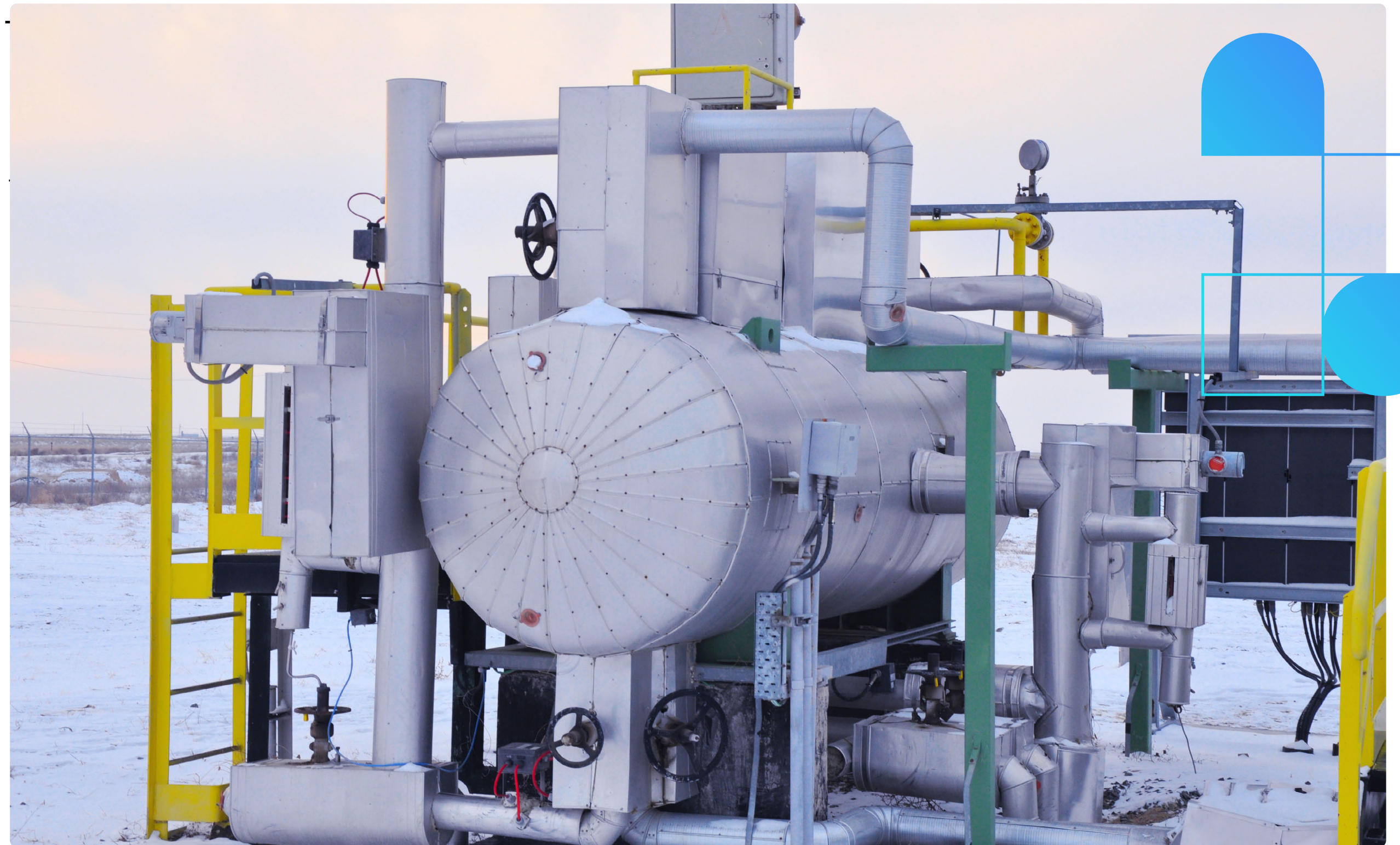
This is how we use technology to move beyond an engineer’s gut reaction to a data-driven response. **When the data is available and structured in the relevant context, applications can tell engineers what to look at first.**

Automate workflows

This is the big goal: fully automated operations, so closely attached to data that software can continuously monitor and adjust based on real-time conditions and without human action.

Today, many assets have implemented some level of automated control. Simple examples include level

controllers in separators and other tanks. A more advanced example would be automatic startup after a shutdown. This involves the startup of all the individual assets in the optimal sequence such that maximal and stable production is achieved as fast as possible without tripping the plant in the process. Additionally, physical process simulations used to plan or troubleshoot production could be automatized in a data pipeline running on a schedule or every time the process parameters change significantly.



↘ Cognite BestDay

Cognite has developed a suite of software as a service (SaaS) applications that showcase the power of contextualized data in Cognite Data Fusion®. For production optimization in the oil and gas industry, Cognite offers BestDay, which provides a framework that enables companies to continuously and objectively evaluate their optimization potential and bottlenecks through data-driven workflows.

Jointly developed and tested with the Austrian multinational integrated oil, gas, and petrochemical company OMV, BestDay helps companies raise their maximum production capacity by providing real-time organizational visibility on all important aspects of production.

0.5-1.5%

Increased
throughput

1,000s

Engineering
hours saved
per year

[WATCH COGNITE BESTDAY IN ACTION →](#)

BestDay targets the full production performance management process, helping companies:

Know their capacity. BestDay uses a data-driven AI model that calculates tomorrow's potential based on historical performance and configurable production constraints or criterias, baking in the requirements for safe, sustainable, efficient, and high-quality production. The model can be tuned with subject-matter experts for their production assets, enabling efficient benchmarking of the performance across a larger production portfolio.

Know their actual production. Real-time access and monitoring in BestDay enabled by Cognite Data Fusion® automates processing, contextualization, and visualization of actual production across hierarchy levels, tying in output from virtual flow meters where real-time metering is not available.

Detect deviations. BestDay's deviation detection AI models provide a real-time view of the most critical tasks, enabling timely and efficient decision-making. This provides the data foundation to drive continuous improvements across planning and execution, and fosters enhanced collaboration and better decision-making that in turn will reduce the volumes of losses.

Identify root causes. BestDay acts as the central hub for troubleshooting and root cause identification across disciplines and shifts through access to real-time sensor data, deferments, custom

production advisors (such as a Grafana dashboard, a spreadsheet on a shared drive, a custom data science solution, or any other web-based solution), and a toolbox for manual root cause analysis and time series calculations.

Mitigate deviations and log production deferments. BestDay enables operations teams to identify and reduce the duration and impact of dynamic deviations, and gather the data needed to analyze patterns in performance over time. This drives up the efficiency of operations and lets experts take targeted improvement actions in areas with the highest estimated return on investment.

Achieve a step change in risk management. Due to the modular design of BestDay, companies can define specific production criteria for safe operations and key performance indicators (KPIs) within sustainability such as energy efficiency, chemical use, emissions, and more. Both the production criteria and the KPIs are incorporated into BestDay's data-driven AI models as conditions that can't be broken. This ensures that environmental safety becomes embedded in operations and ways of working.

[LEARN MORE ABOUT COGNITE BESTDAY →](#)

OMV and Cognite deploy BestDay

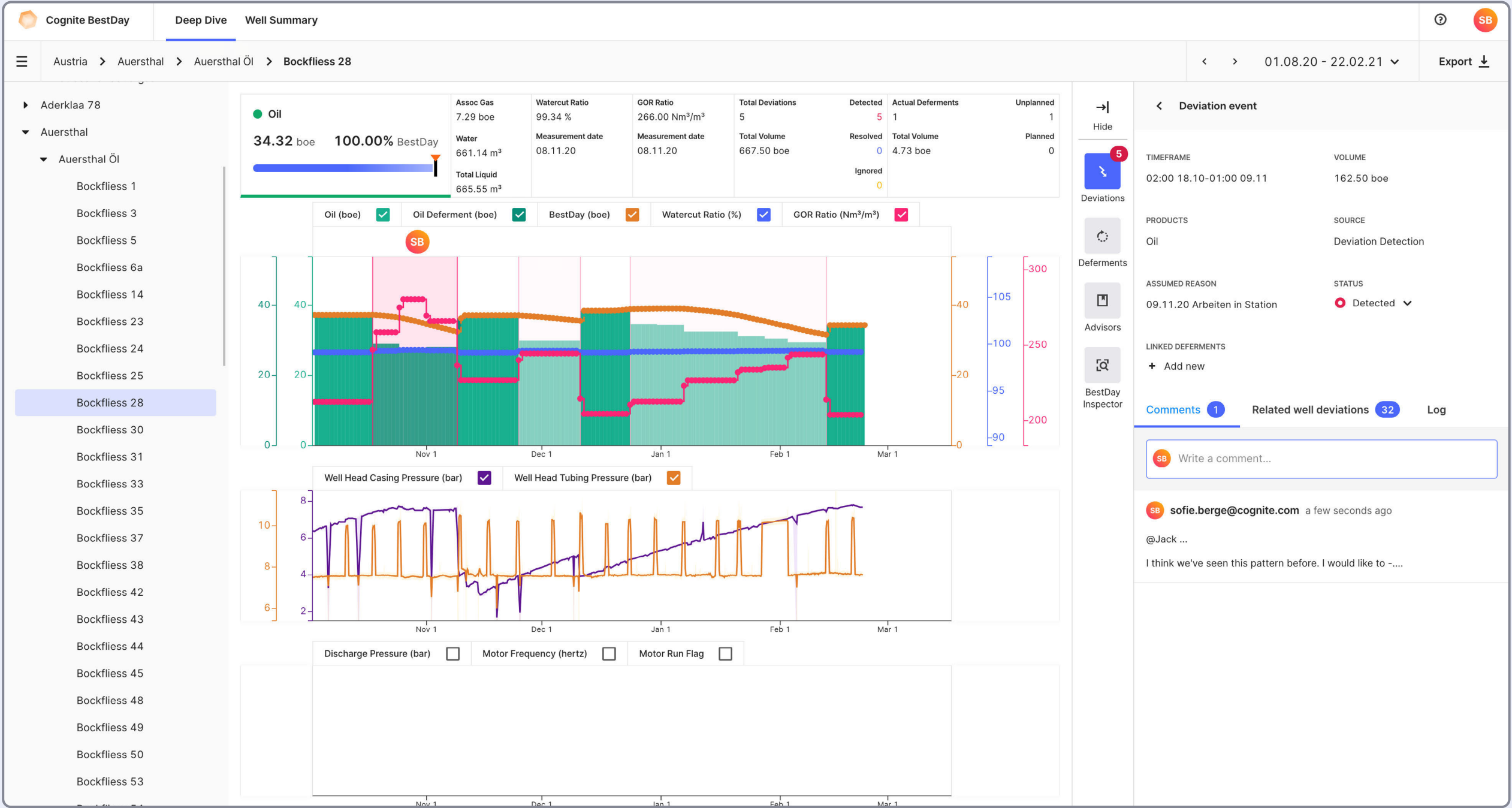
In 2021, OMV and Cognite began rolling out BestDay, starting with the oldest oil giant of Austria: the Matzen oil field. At 93% production efficiency, the mature field with 800 active wells was already a top performer, but BestDay will take the field to the next level in terms of production efficiency, 70 years after first oil.

The resulting production gain for the Matzen field is estimated at 0.3-0.5% per year above the current production profile. BestDay is also estimated to save 10,000 hours per year in engineering time. This example shows the potential of using digital tools to unlock new value from industrial sites that have been in operation for decades.

BestDay’s full potential is estimated to drive a production efficiency gain of up to 1.5% (for an average production hub of 26,000 barrels per day), an increase worth about \$7 million a year.

“Rolling out the application in fields with a production history ensures that we can actually back calculate the performance increases. Since we already have all our assets integrated in Cognite Data Fusion, the marginal cost of scaling is negligible.”

Philipp Toppel, Vice President
of Global Production, OMV



↘ Cognite Data Fusion® in action

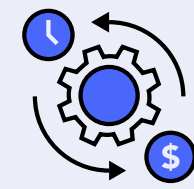
How Aker BP is taking a hybrid AI approach to optimizing production

Challenge: Produced water disposal is one of many challenges at oil and gas facilities with high water-cut wells. Keeping the oil contamination level in the produced water below environmental limits requires an efficient separation process. Obtaining produced water that meets environmental regulations requires an efficient separation process, which is governed by a series of complex physical interactions.

Significant production losses are associated with situations with high oil-in-water levels, because safely discharging water to the sea requires slowing down production while troubleshooting for bad actors at the facility.

To identify what could be causing a high oil-in-water concentration, operators often take spot sample measurements at different parts of the production facility and then perform mitigating actions once the bad actor is located.

Operators rarely have much information to determine where to start the search, however, which can make finding the bad actor a time-consuming process.



\$6M

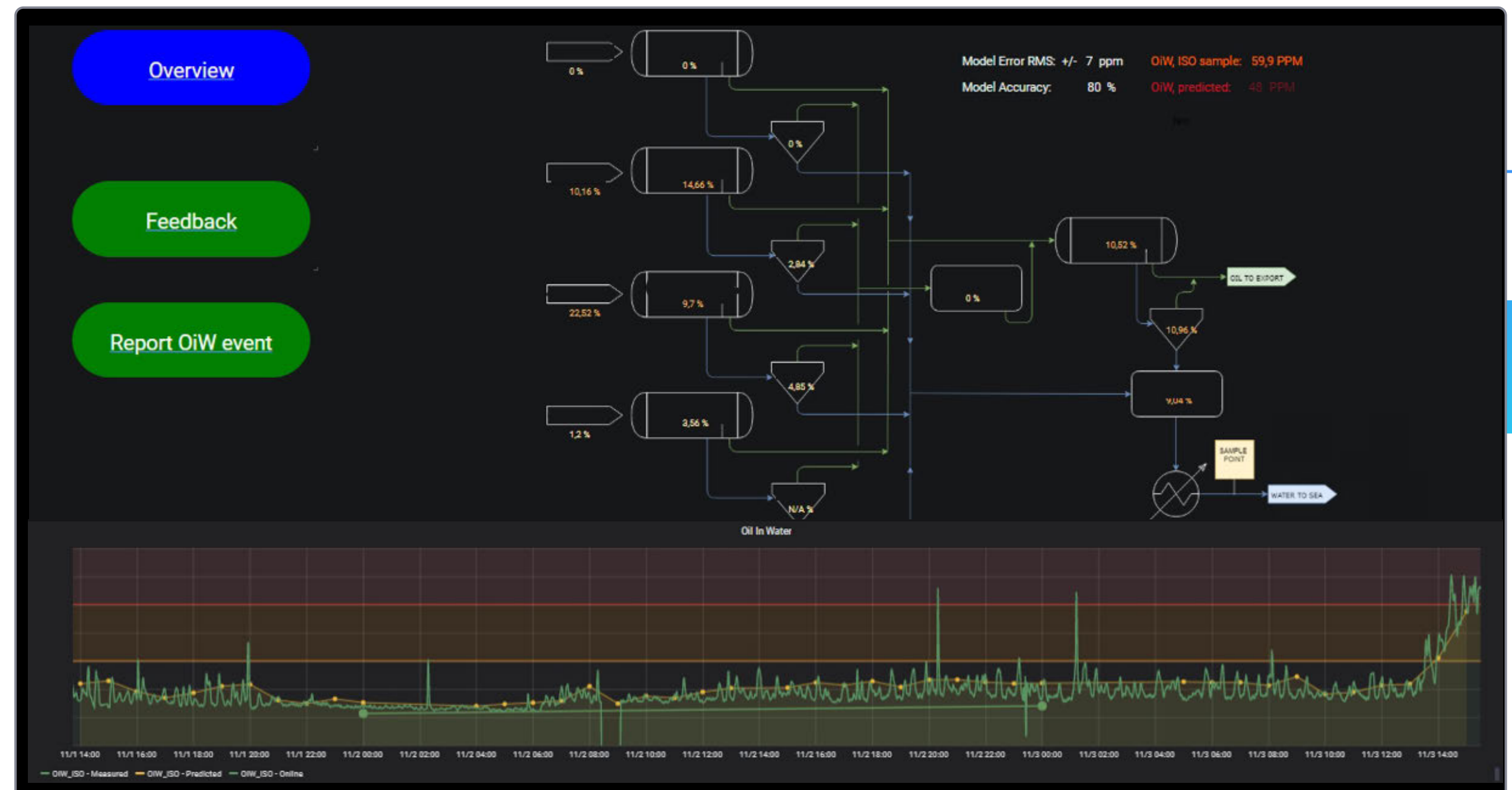
Estimated annual savings and reduced production losses



Reduces time needed to identify bad actors behind high oil-in-water levels



Secures regulatory compliance and prevents environmental incidents



Solution: Aker BP, Expert Analytics, and Cognite have implemented a **smart monitoring** system that visualizes all data relevant for troubleshooting water contamination and a **recommender system** with an underlying machine learning model to identify bad actors related to high oil-in-water concentrations.

The **smart monitoring system** displays near real-time data from Cognite Data Fusion®, visualizing it in an intuitive Grafana dashboard. Additionally, calculations combining sensor values and simulator outputs provide engineers with virtual sensors and physical properties they otherwise would not have had readily available.

The recommender system is based on a machine learning model fed with live data from Cognite Data Fusion®. The model, which is trained to predict oil-in-water concentrations based on historical data from approximately 200 physical sensors from production wells and equipment relevant to produced water, determines an importance associated with each parameter or property in the production facility. This in turn can be used to identify bad actors related to water contamination.

In addition to the 200 physical sensor values, the model is also fed values from approximately 100 virtual sensors. One example is how data from pressure and temperature sensors is converted to fluid properties by applying the laws of thermodynamics and information about the fluid composition. Finally, the model also considers virtual sensor values obtained from multiphase flow simulators

such as flow rates from individual wells.

Impact: The smart monitoring system gives engineers the ability to troubleshoot issues related to water contamination in a single dashboard, increasing their situational awareness. This allows users to take informed actions based on the available data and solve problems faster. When the proposed recommender system is in place, it will be an integral part of the monitoring system that will highlight which parts of the production facilities may be important to the current oil-in-water concentration.

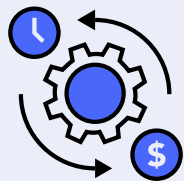
This serves as a starting point for investigating the problem, and is a significantly faster approach to identifying mitigating actions related to water contamination. **Aker BP estimates that decreasing the time spent finding mitigating actions has an annual revenue potential of \$6 million.** The system could also have a net positive environmental impact.

How Aarbakke and Cognite are extending the lifetime of CNC machines

Challenge: Aarbakke has dozens of computer numerical control (CNC) machines at its factory in Bryne, Norway. The machines complete complex operations on sometimes rare materials to achieve the highly precise product requirements that Aarbakke's customers in the oil and gas industry demand.

Historically, the CNC machines have sometimes been unknowingly operated in a suboptimal way, and there have been no alerts or warnings prior to them breaking down. Issues include high temperatures in coolants or oils, which lead to wear and tear; wrong pH and salinity in the coolant, which can cause corrosion or bacterial or fungal growth; incorrect lube oil consumption; and missed maintenance on the machines.

Aarbakke lacked a master log of these machine alarms, as well as a system to filter out less critical ones. Service managers previously depended on operators to send them a note every time a critical issue occurred. Otherwise the service managers needed to physically go to each individual machine and manually pull a local log to view the alarms.



20-30%
Reduced service costs



Reduced downtime
and unplanned stops



Timely alerts ordered
by priority

Solution: Aarbakke and Cognite first liberated data about machine alarms from its source system, ingesting it into Cognite Data Fusion®.

With all data streaming from one place, the developers then created a dashboard that shows an overview of all alarms but also groups alarms by machine and issue. **This helps service engineers pinpoint specific issues and machines and take targeted maintenance actions to address them.**

Aarbakke and Cognite plan to add more functionality to the dashboard in the future, including a feature that lets service managers assign levels of criticality to alarms, ensuring that the alarms they deem most important will always be featured at the top of the list.


Impact: Improved monitoring of operational parameters and the ability to look at records of alarms and warnings centrally will reduce the number of breakdowns and extend the lifetime of the machines. Beyond that, collecting cleaned, contextualized data about alarms will help drive Aarbakke toward a future in which the company can predict potential failures before they happen.

Aarbakke estimates that the dashboard will cut service costs by 20-30%, reduce downtime, and avoid unplanned stops due to mechanical reasons.

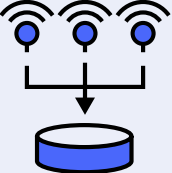
How Cognite Data Fusion® speeds up the power grid connection process



\$1.2M
Estimated annual value



Less time spent
collecting & cleaning data



Assets connect
to the grid faster

mation from different systems. That may include customer information, sensor data from the power grid, information about how other grid connection

Challenge: To meet the needs of an increasingly electrified society and accelerate the shift toward renewable energy, grid operators need to be able to connect new power generation systems and consumers to the grid in a safe and efficient manner.

To process grid connection applications, grid operators conduct feasibility and impact studies to determine whether or not the grid, as currently constructed, can handle the additional load. If not, the network will need to be upgraded.

These studies are time-consuming analytical tasks. Grid operators often need to examine several years' worth of historical data to review how the grid has changed over time. They also need to be able to look into the future to see how one application to connect to the grid may affect other applications that are being processed, and how it might interfere with other planned work on the grid.

Much of this process involves gathering infor-

mation from different systems. That may include customer information, sensor data from the power grid, information about how other grid connection

Some grid operators have found that as much as half of the time it takes them to process a grid connection application is spent gathering and cleaning data. This, combined with the growth in renewable energy companies looking to connect their assets to the grid, means that it is not uncommon for grid operators to have a backlog of applications.

Solution: Statnett, the Norwegian transmission system operator, worked with Cognite to liberate information from its source systems, including operational statuses, disconnections, generation capacities, and sensor data, and ingest it into Cognite Data Fusion®.

After the different data sets were structured in context with one another, the development team created an easy-to-use application that helps Statnett's analysts explore the contextualized data.

The application enables users to quickly navigate through different assets on the grid and easily look up information on load, capacities, and disconnections, which can then be visualized or prepared for further analysis.

Impact: With all the relevant information needed to process grid connection applications accessible in one location, grid operators can more efficiently add new power sources and consumers to the grid. This benefits both the grid operator and society in general.

Statnett estimates that improving how it processes applications is worth an estimated \$1.2 million a year. Half of this figure is related to the grid operator's own efficiency gains, as its analysts no longer have to collect and clean data from different systems; the other half, societal benefits created by reducing the time it takes to connect to the grid. The latter figure is difficult to estimate exactly, and depends heavily on the type of player wanting to connect to the grid. In cases of heavy industry or large power generation facilities experiencing delays in grid connection, the number can easily be many times higher.



Conclusion

From automation and an aging workforce to electrification and the energy transition, the challenges facing asset-heavy industries are complex. Production optimization must be part of industry's plans to succeed in the future, whether the asset that needs to be optimized is a well, a factory, or an entire power grid.

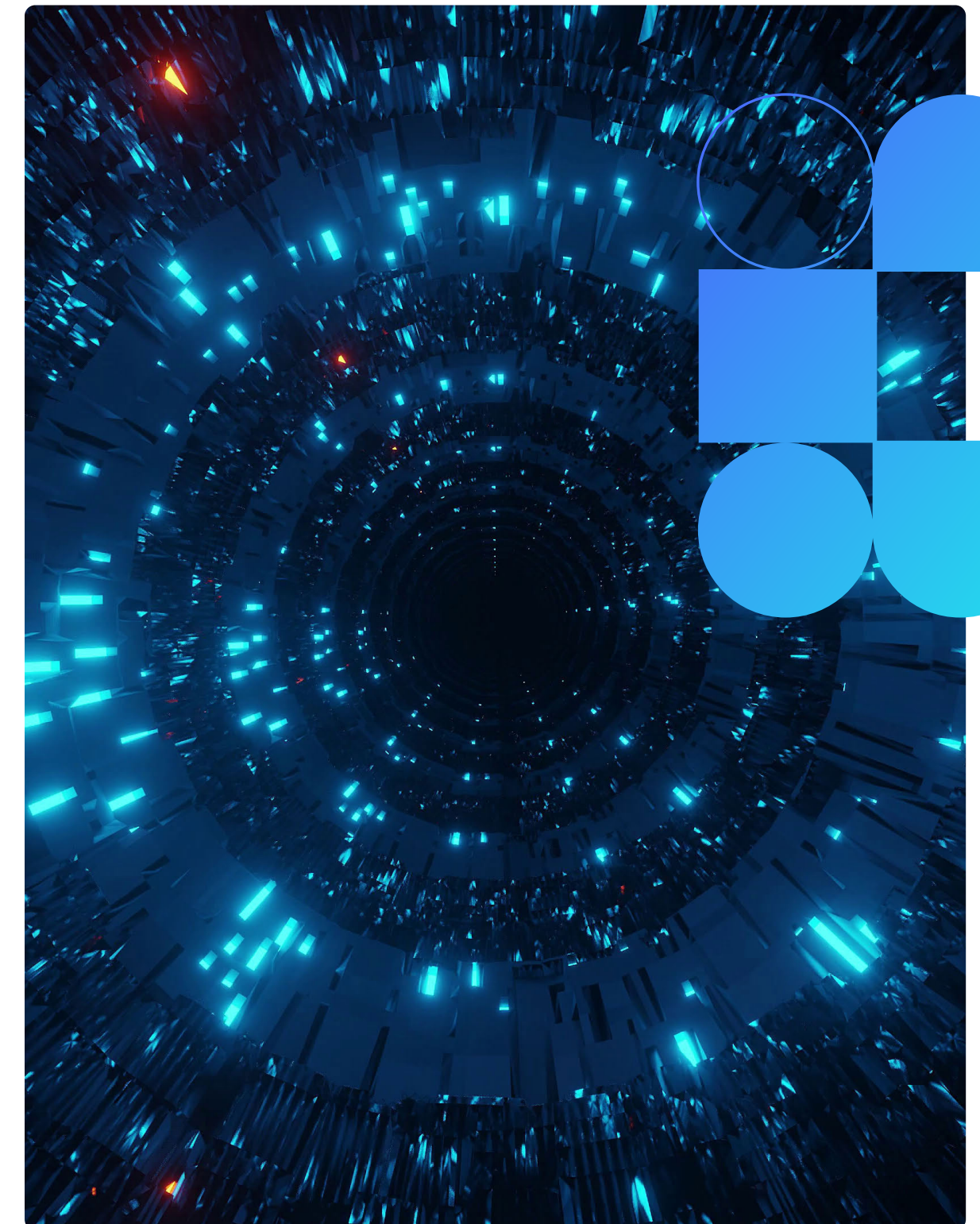
Tackling these challenges starts with getting the right data with the right context to the right users at the right time for the right problem. **Industrial DataOps can help companies take control of their operational data to make it accessible, meaningful, and dependable.**

Giving people at every level of the production team access to data in the most intuitive format achieves three things:

- It increases the efficiency and efficacy of the engineers' daily tasks, resulting in maximized throughput.
- It supports the ongoing organizational transition to more dynamic, data-driven ways of working.
- It inspires experts to find new ways to use data, algorithms, and software to solve problems and shape the future of their companies and industries.

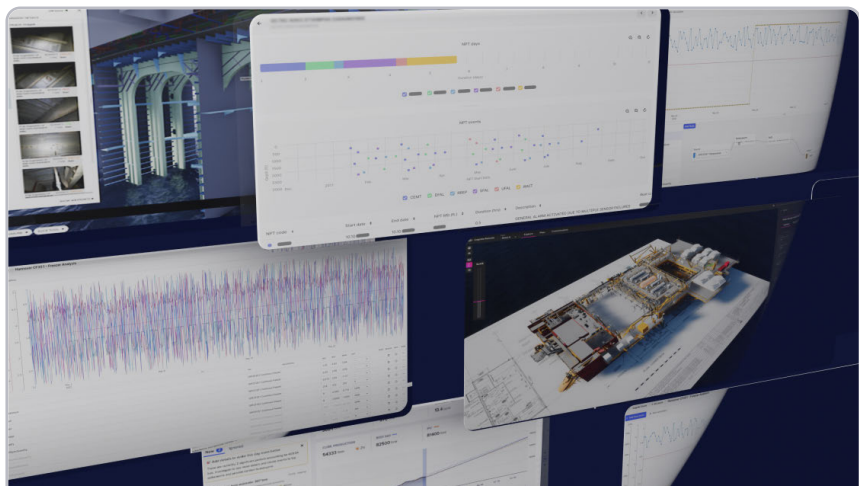
Optimizing production means more than just increasing quantity. By breaking down their silos and making their data broadly available and usable, companies in asset-heavy industries can also make safety and sustainability—in other words, quality—part of the formula for the future of industrial operations.

Reach your maximum production capacity with Cognite Data Fusion®, the leading Industrial Data-Ops platform.



Want to know more about our product?

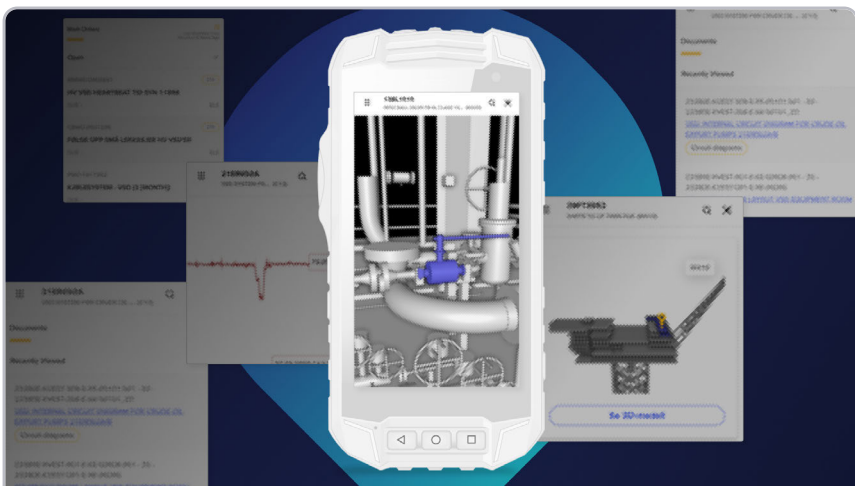
Explore more insights from Cognite



PRODUCT TOUR

Learn from Cognite customers and product managers how Cognite Data Fusion® simplifies and streamlines the data experience of a subject matter expert.

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CUSTOMER STORIES

Discover how Cognite Data Fusion® makes data more accessible and meaningful, driving insights that unlock opportunities in real-time, reduce costs, and improve the integrity and sustainability of your operations.

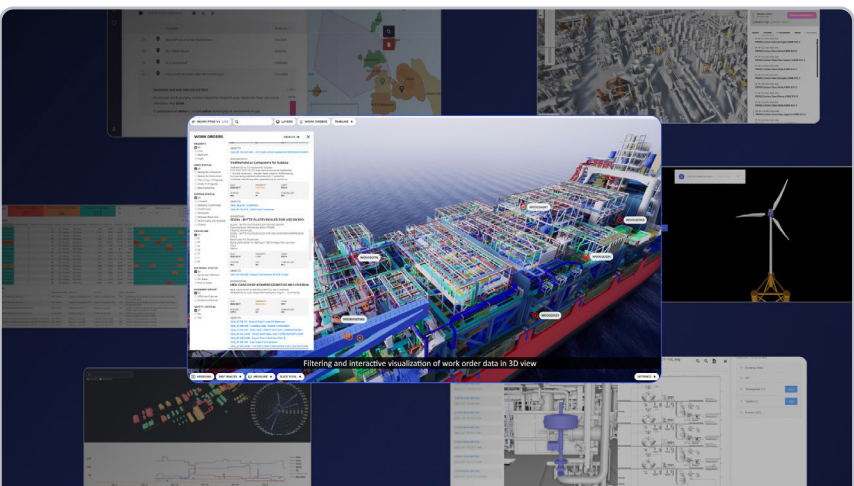
[GO TO STORIES →](#)



ANALYST REPORT

Customer interviews and financial analysis reveal an ROI of 400% and total benefits of \$21.56M over three years for the Cognite Data Fusion® platform.

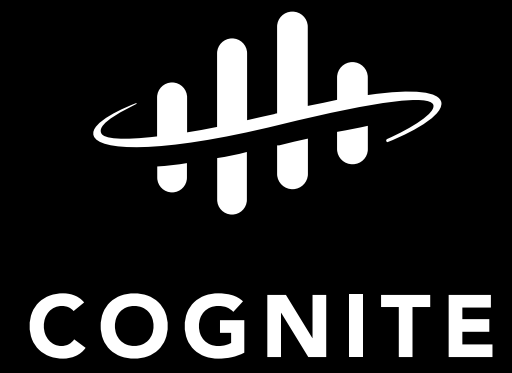
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