



# How Utilities Can Manage Unprecedented Operational Change With DataOps

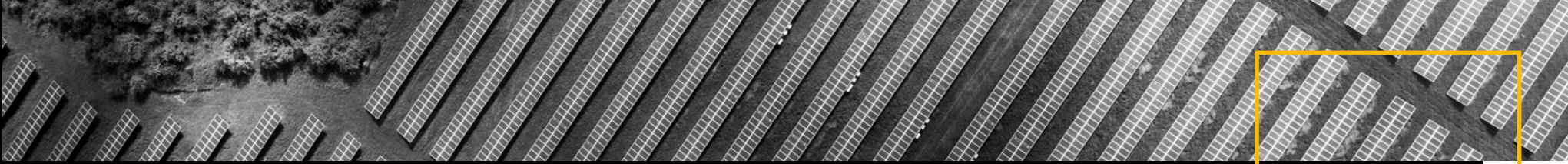


COGNITE



UTILITY DIVE

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# WHY UTILITIES NEED DATAOPS

Utilities are gathering more data than ever—from equipment, sensors, business processes, customer interactions and third-party sources. This data can drive down risk from operational change by helping utilities understand patterns and trends, and also by increasing flexibility and nimbleness. For utilities to become driven by data, rather than drowning in it, they must effectively and efficiently deliver the right, meaningful data to the personnel and applications that need it.

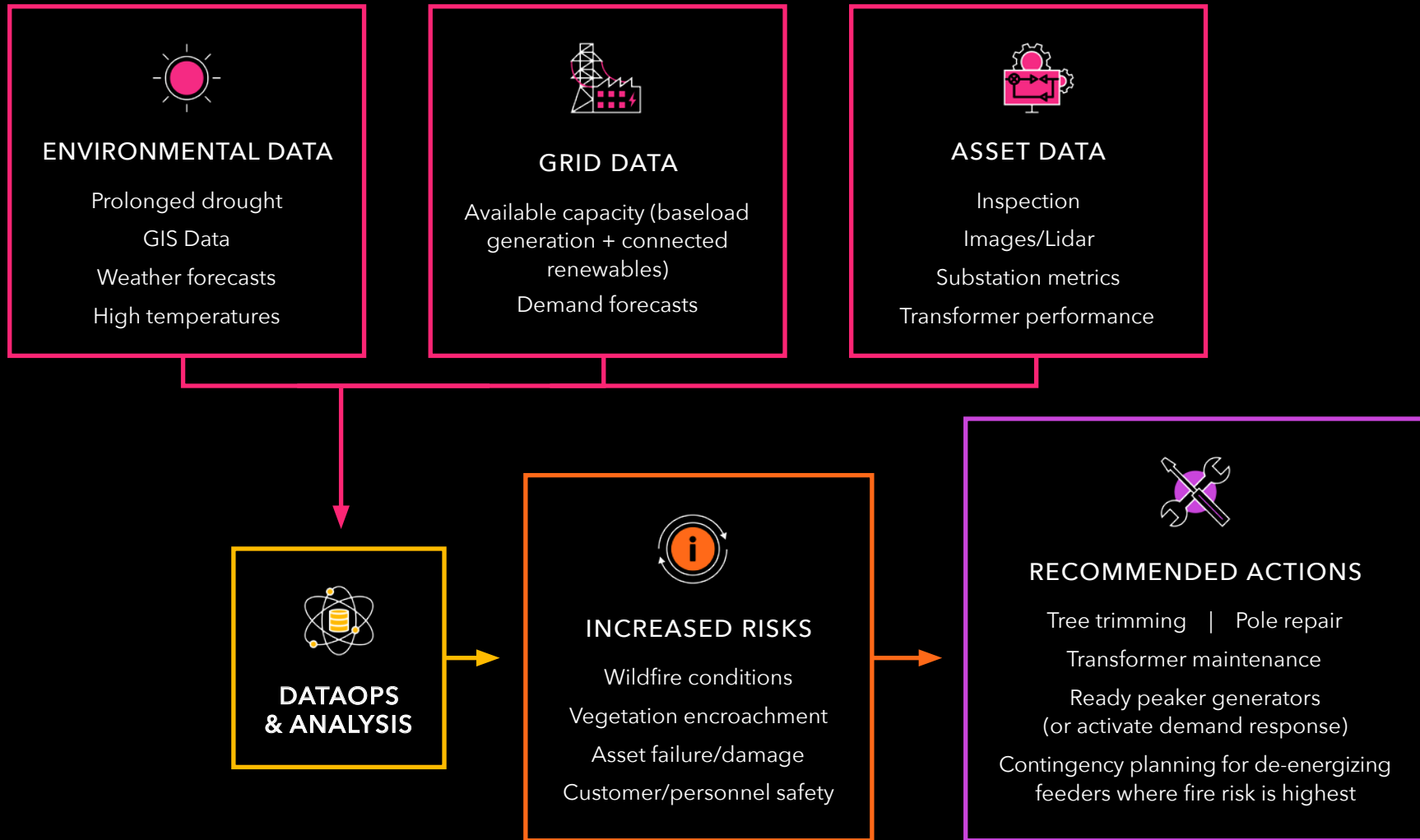
So far, most utilities are not yet using their wealth of data to full advantage. Achieving this goal is nearly impossible

when operational data is divided across the utility, buried under layers of complexity, and often lacking context that makes it meaningful.

Turning data into a useful operational tool requires robust systems to make data available, understandable and usable across the entire utility. The emerging discipline of DataOps empowers utilities to build a pipeline that reliably and automatically supplies high-quality data wherever it is needed.

“DataOps tackles the high-overhead problems associated with data management and operationalization,” explained Gabe Prado, director of product marketing for power and utilities at Cognite. “Today, it still takes too many steps to add humanlike meaning to data and efficiently integrate the data into applications. **The key is to make that process smooth, clean and dependable so applications can return value to operations and the business.**”

# DataOps accelerates the process by which distributed operational data is transformed into practical recommendations.



DataOps allows both operational technology (OT) and information technology (IT) data to be assembled, preprocessed and used cross-functionally. Personnel can easily discover, access, understand and apply data from across the enterprise to answer their own questions. This supports optimal alignment of people, processes, technology and assets. Ultimately, DataOps can help foster a more nimble and resilient utility, both operationally and culturally.

**"Recognizing data as an enterprise asset... can be tremendously helpful in shifting utility culture and supporting digitalization."**

**ADRIANA KARABOUTIS, GLOBAL CHIEF INFORMATION AND DIGITAL OFFICER FOR NATIONAL GRID**

"From a technology perspective, working with data is relatively easy. But culture is hard," said Adriana Karaboutis, global chief information and digital officer for National Grid. "Recognizing data as an enterprise asset, and getting past thinking that each department owns its set of data, can be tremendously helpful in shifting utility culture and supporting digitalization."





# DataOps Solves 3 Fundamental Data Problems

## **ACCESS.**

How can users get to the data they need? Especially when it resides deep in a control system or across a variety of sources. Who is authorized to modify, correct and update it? Aside from the owner, who is allowed to access or share each type of data? What are the rules for how data can cross between departments and systems while complying with security and privacy requirements?

## **QUALITY.**

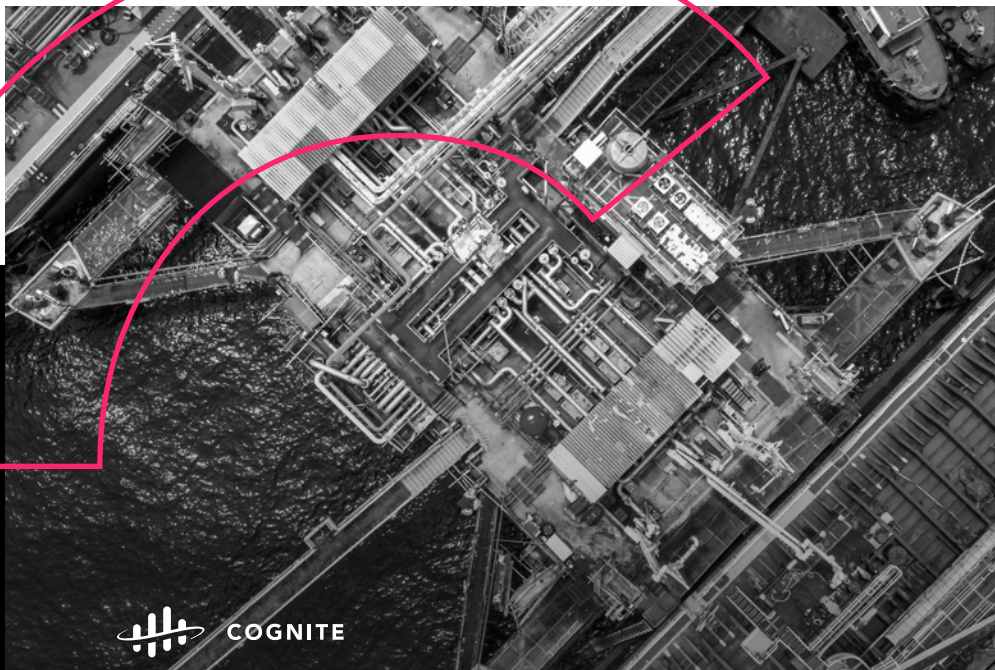
Can data be trusted so that people can trust decisions, reports and predictions based on that data? Is the data accurate, complete and consistent? Are users across the enterprise all working from the same "single source of truth"? In particular, artificial intelligence and machine learning demand excellent data quality.

## **TIMELINESS.**

Nearly every kind of utility data has an expiration date, after which its relevance drops. When any part of the data supporting operational decisions, financial projection or situational awareness is stale, consequences can be costly. How can automation make data easier to use and apply so that value can be captured more quickly?

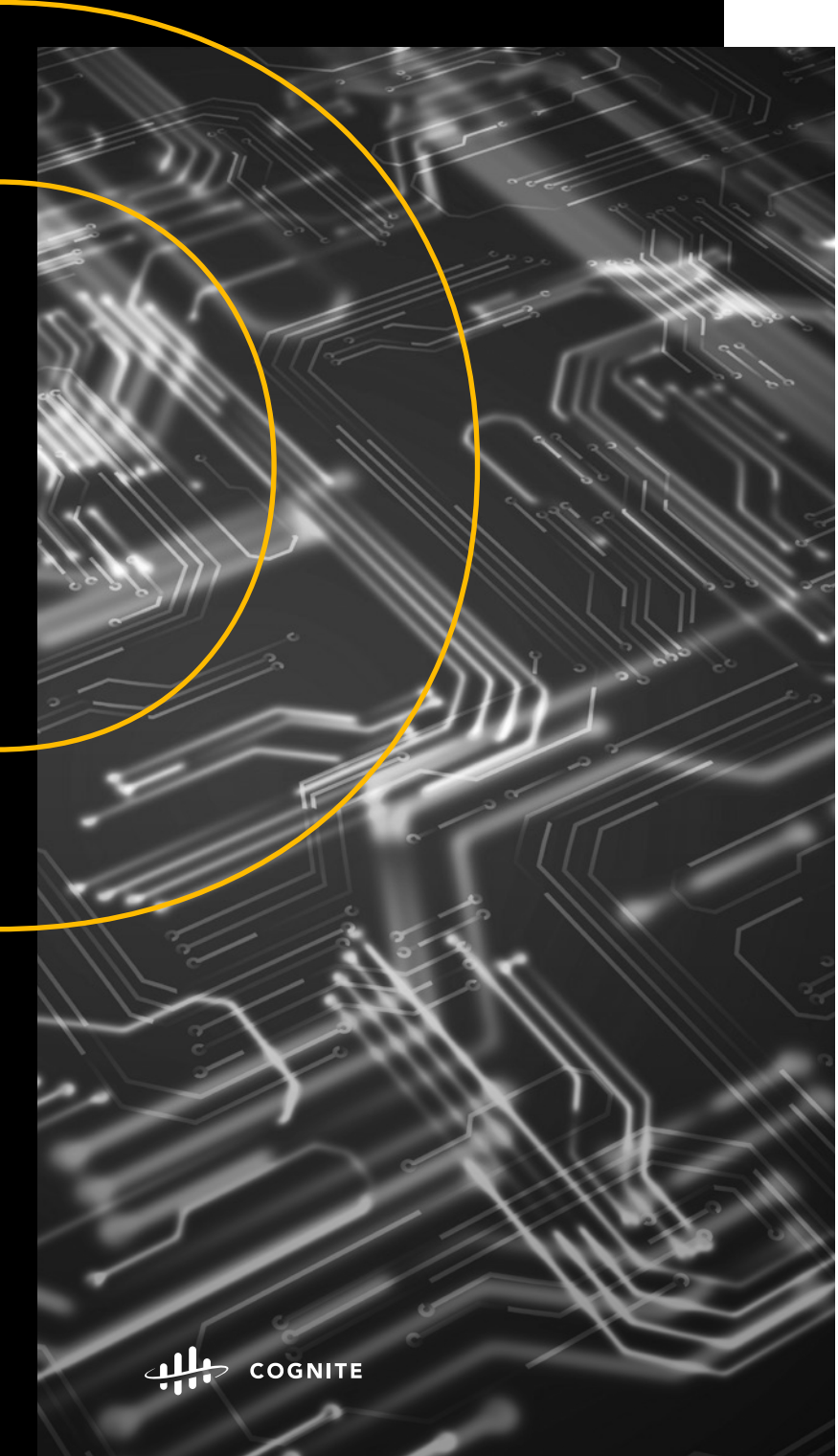
As almost every aspect of utility operations is undergoing profound change, systematically liberating data across the utility supports optimal realignment of people, processes, technology and assets. This empowers utilities to address challenges related to ongoing disruptions, such as:

- **SHIFTING ENERGY SUPPLY AND DEMAND PATTERNS**, both short-term (such as from the COVID-19 pandemic) and long-term (from renewables, technology evolution, shifting consumer needs and more active grid participation from “prosumers”).



- **RIISING RISKS TO INFRASTRUCTURE AND SAFETY.** Climate change is yielding more severe storms, wildfires and floods while also shifting routine weather patterns. This complicates predictive maintenance, outage response and plans for system upgrades. Utility assets are more likely to incur damage or failure, risking harm to utility personnel and the public.
- **WORKFORCE EVOLUTION.** Remote operations are increasingly common at utilities – partly due to the COVID-19 pandemic, but also due to a long-term trend of wider deployment of sensors, automation and robotics. Also, as experienced employees retire, the value of their accumulated experience and insight must be preserved. At the same time, utilities face daunting competition for new talent with strong digital skills.

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of utility operations  
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profound change.



Big change presents opportunities as well as challenges. Recognizing this, more utilities have adopted innovation as a business strategy. Robust access to data allows innovation to flourish by revealing the best opportunities and resources, encouraging exploration and experimentation, and supporting smart decisions.

“DataOps is at the heart of where everyone is going in the utility industry,” said Karaboutis. “Data leads the way toward insights. Today the challenge is: How do utilities bring in operational data – readings from sensors, substations, etc. – to support decisions and predictive analytics? Building your data foundation will allow you to accomplish digitalization.”

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AND DIGITAL OFFICER FOR NATIONAL GRID



# MAKING UTILITY DATAOPS HAPPEN

Automation helps organizations fix overload and bottlenecks of any kind. DataOps directly addresses the quandary of data supply/demand noted in the research paper [DataOps in Manufacturing and Utilities Industries](#): “While data generation is spontaneous, its consumption is not. With data piling up every day, fresh ways of thinking are required to accelerate its consumption and usage.”

At utilities, silos are the most fundamental obstacle to spontaneous, ubiquitous data access. Historically, utilities have been highly siloed organizations, especially with limited interaction between operations and other departments. As utilities adopted computers, this translated into the IT/OT divide: IT has been mostly managed separately from OT.







Now that the operational technologies of power generation, distribution and consumption have themselves grown highly digitized, IT and OT are merging. Utilities must unify their management. Building a “data backbone” infrastructure does more than connect silos; it also creates opportunities to overcome these common problems with utility data:

- **INCONSISTENT DATA TYPES.**

Utility data exists in a vast range of formats (structured and unstructured), which are used in different ways by different departments and systems.


- **METADATA DEFICIENCIES.**

The contextual tags and categories used to characterize data often are missing, inconsistent or hard to interpret. Without good metadata, data is difficult to understand and use.

- **VENDOR LOCK-IN.**

Many utilities rely on equipment and software that use proprietary data formats, which can limit a utility's access to its own data.

The first step in bridging silos is to standardize and integrate utility data stored in department-specific repositories or systems. This involves creating an inventory of data, systems and users, then connecting them in useful ways.



Security (physical and cyber) can be a sensitive issue when bridging utility data silos. Compartmentalization has long been a protective strategy for utilities. Malware that enters a utility via an internet-connected IT system (such as email or enterprise resource planning) might migrate to connected systems for customers or operations, increasing the risk of data breaches, outages and even damage to assets and people.

Cloud-based DataOps platforms can enhance security. Rather than building direct interfaces between departmental systems, data is transferred from one system to another via the cloud. This creates a layer of abstraction that serves as a safety buffer between systems, preventing potentially harmful executable code from accessing the control systems. Cloud-based DataOps also offers the enhanced layers of security offered by cloud vendors.

“Regulators are very concerned about utility cybersecurity and privacy,” Karaboutis said. “Talking to regulators about DataOps is an opportunity for utilities to have this discussion in a constructive way. Both regulators and utilities want to do more for stakeholders, and DataOps enables that while managing the complexities of security and compliance.”

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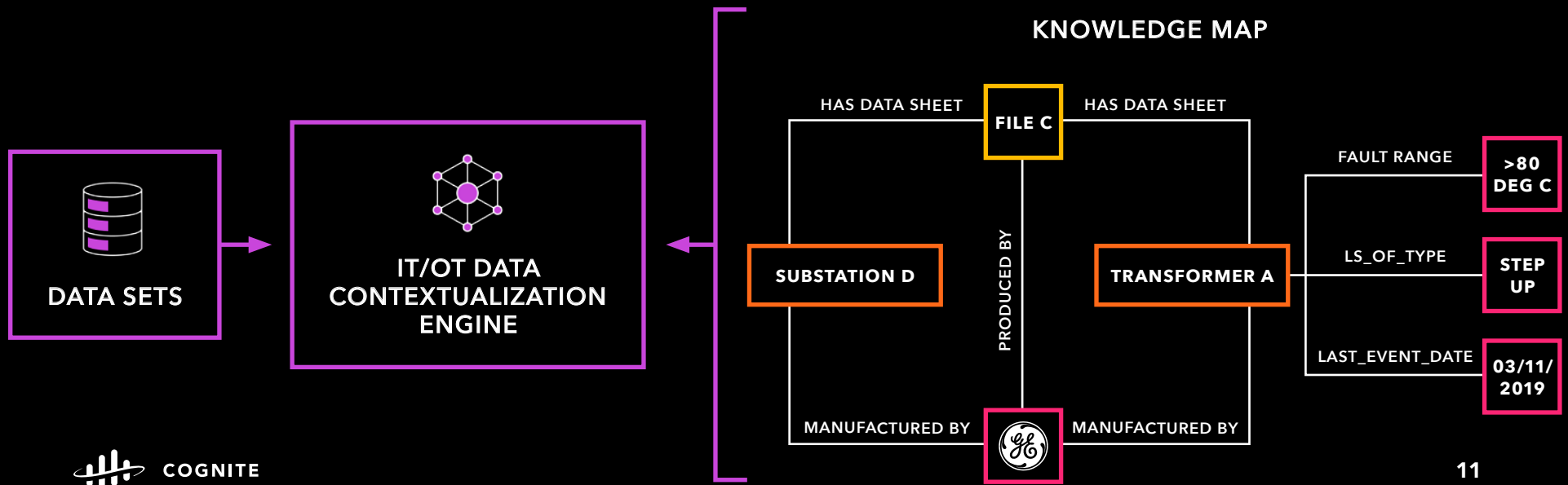
The next step in implementing utility DataOps is to automate context. Data is only useful to people when it has meaningful context. “Humanizing” data involves recognizing and replicating the immense amount of effort that people already invest to manually place information into context.

The contextualization engine in a DataOps platform automatically applies intuitive, consistent metadata that clarifies relationships between data sources and types. For example, operating data from a substation would be tagged automatically according to the originating device/component (such as “transformer 3”), the information conveyed by the data (such as load or temperature), the date and time, and pertinent characteristics (such as condition, efficiency or safety).

Cross-departmental teams work together to develop metadata schema (labels and hierarchies) that support unaided interpretation by people working in a variety of roles or departments, on a variety of problems. For instance, a financial analyst budgeting capital-improvement projects might want to identify specific grid assets that are likely to fail in the next three years, how much those failures might cost and how to replace them most cost-effectively. When the finance department has some input and insight into metadata, a mass of otherwise arcane technical details can be easily interpreted

by someone who knows little about how transformers work. This yields answers to important business questions.

The end result of this preparation is a functional data model. This “single source of truth” enables more users across the utility to access and use data, regardless of where it originated. It allows people to focus on business or operational issues, not data issues. It also supports efficient real-time access to data via open application programming interfaces (APIs) and standard development kits (SDKs).



# DATAOPS FUELS UTILITY INNOVATION

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Utilities exist in a highly dynamic landscape, where market opportunities, technologies and the operating environment are constantly changing. Harnessing data not only helps utilities understand what's going on around (and within) themselves, but it also points the way to the future. DataOps equips utilities to perform better, faster, more accurate analysis and then operationalize the analysis into applications. This supports short-term gains (such as deploying a predictive model) as well as long-term success (such as changing an entire workflow, or optimizing capital investments).



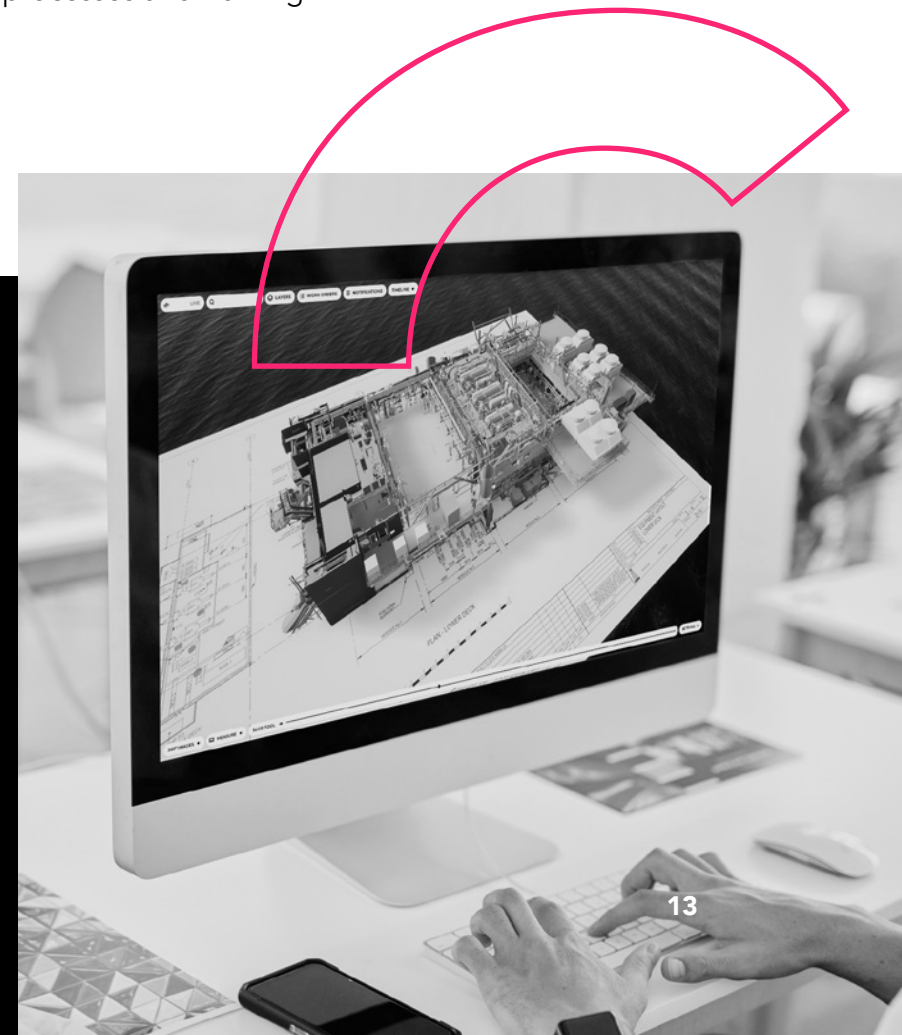


DataOps also makes it easier for utilities to connect the dots between important issues, allowing room for gains in the face of disruption. For instance, the COVID-19 pandemic drastically disrupted utilities in early 2020, causing sudden major changes in their internal operations as well as in energy-consumption patterns. To adapt, utilities learned how to conduct more work by remote, with fewer personnel in offices and at plants. This has accelerated interest in more sophisticated modeling.

"Remote-working tools depend on reliable access and trust in data," Prado said. "The imagery, locational data, video feeds and text chats all get captured in different systems and have to integrate together to paint a vivid picture of the operations. This is how utilities can work smarter, not harder, even after workplace health concerns return to a more normal level. It can help preserve institutional memory and improve processes and training."

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GABE PRADO, DIRECTOR OF PRODUCT MARKETING FOR POWER AND UTILITIES AT COGNITE




The need to support increased remote work has raised utility interest in increasing the quality and scope of modeling, including digital twin capabilities. “If you need to replicate the experience of a worker on-site at a plant, the digital twin effectively becomes the plant. But it’s also where you can run simulations and projections, to try out different scenarios,” Prado said. “When all the data relationships are mapped out and constantly updated, any authorized personnel can use that model to get a more realistic idea of what could happen and where the opportunities for improvement are.”

On an ongoing basis, DataOps can help utilities adapt to more routine disruptions. Ideally, this should include data about what’s happening in the world outside the utility. “Events start coming into the mix of relevant data. If there’s a big soccer match happening this week, that might affect the amount of energy needed to keep the grid balanced,” said Karaboutis. “Consider all triggers or sources of data and ask: How can we make this more accurate? How can we distribute this data faster, treat it with more rigor, to gain better insights? Then you start scaling up the use of data. DataOps becomes a discipline in and of itself.”

**DataOps can help  
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routine disruptions.**





**"With good DataOps practices, utilities can spot emerging patterns, especially when they're nuanced."**

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Overall, power systems are becoming more automated and dynamic, generating and using vast amounts of data as they glean ever more efficiency and safety from limited resources. Similarly, consumers are using more sophisticated technologies, from mobile apps and smart thermostats to rooftop solar, battery energy storage and electric vehicles (EVs). Growing consumer interest in playing a more active role on the grid is leading utilities to leverage data as a tool of external communication and interoperation.

"With good DataOps practices, utilities can spot emerging patterns, especially when they're nuanced," Prado said. "For instance, if several consumers in one part of the grid are adding solar or EVs, that can help you optimize and stabilize power flows at different times."

DataOps can help utilities more precisely match consumers with programs and tailor offerings to consumer desires and capabilities. By combining market and operational data, utilities could design special rates and services for EVs or demand response that leverages home or building automation systems. These represent new revenue opportunities as well as potential sources of avoided costs or resource aggregation.

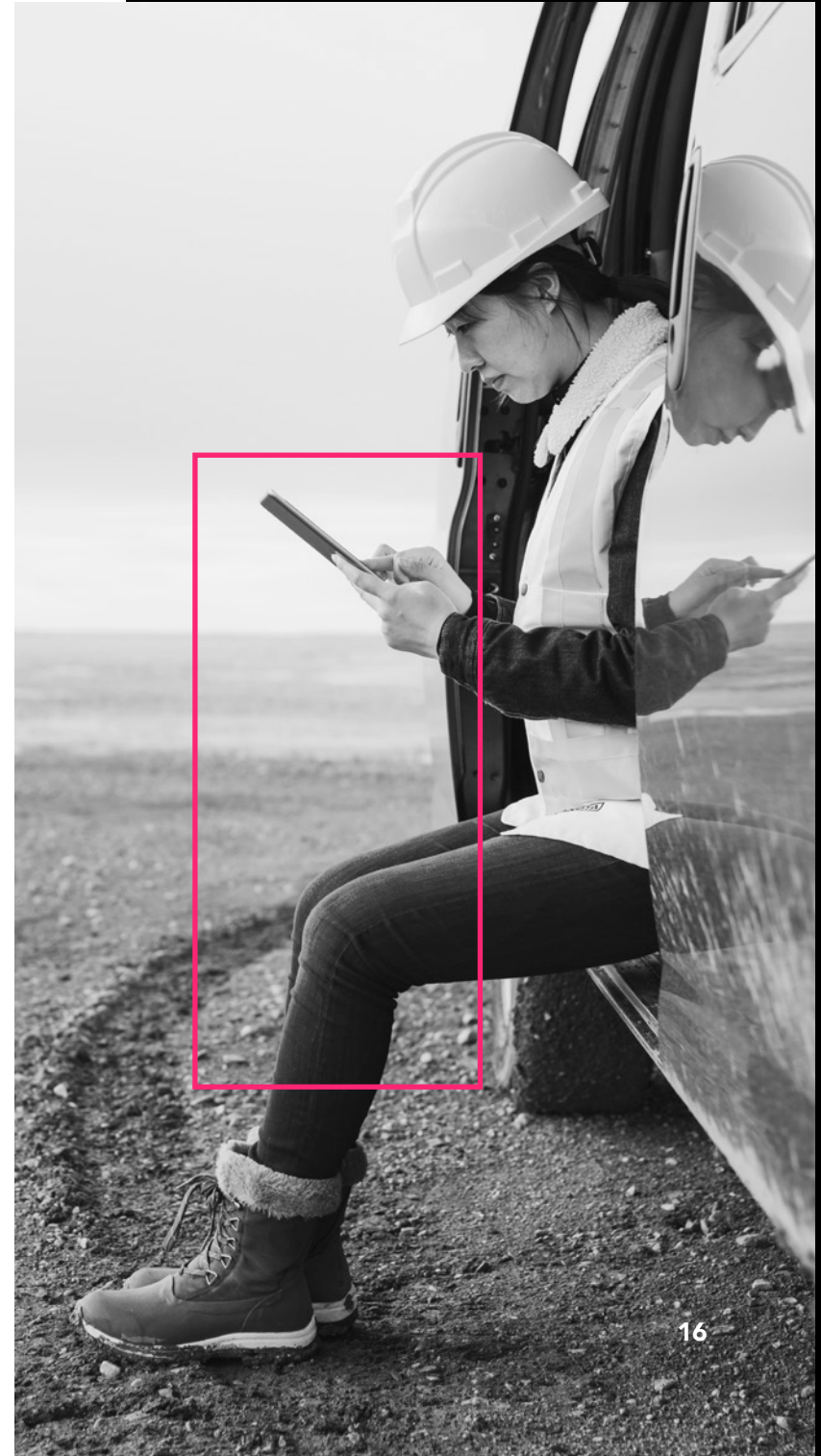
Navigating this much dynamism requires a firm grasp of utility data. Without this, utilities will miss business opportunities and also risk compromising regulatory compliance, efficiency, customer satisfaction, public trust, safety and reliability.

# VENTURING INTO DATAOPS AT YOUR UTILITY

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DataOps is such a versatile capability that it can be challenging to figure out where to start. Fortunately, DataOps augments existing systems and does not require significant infrastructure disruption. Rather, DataOps becomes the fabric that weaves together data, process and experts with tooling and contextualization.

Prado recommends identifying a well-scoped project that has a clear business problem to solve, such as building a dashboard or a predictive model. Ideally, this project would draw data from more than one department or system. Clear goals should be identified up front: What questions should people be able to answer with this new data model?







A utility then must determine which data is available, who owns it and how to access it. Then, DataOps professionals can then work with utility personnel and data scientists to create a data model and populate it with cleaned, current data that is layered with useful metadata.

The goal is for DataOps to become a self-sustaining aspect of utility operations. It's best to start small, with a single DataOps use case that will quickly demonstrate success. Once the model is deployed, the utility evaluates the accuracy of its results and projections, fine-tuning it where necessary. When the model is deemed accurate, confidence in it will grow, and it can be applied to optimize workflows, automation or decisions. DataOps infrastructure can be expanded to explore additional use cases, yielding long- and short-term benefits. Eventually more users can be added across the enterprise which helps the utility adopt a more data-driven culture.

**The goal is for DataOps to become a self-sustaining aspect of utility operations.**

Using sound DataOps principles and tools on smaller projects creates a common backbone of support, which allows utilities to safely expand the scope of DataOps.

Utilities interested in exploring the potential of DataOps might consider these questions:

**1. WHO NEEDS OUR DATA?**

What internal classes of data consumers are emerging at your utility: citizen data scientists, product managers, digital teams, etc.? Do they have the data access they need?

**2. ARE WE RESPONSIVE ENOUGH?**

At this time, can we easily and quickly find the data needed to answer ad hoc operational, business or regulatory questions?

**3. ARE WE WASTING RESOURCES?**

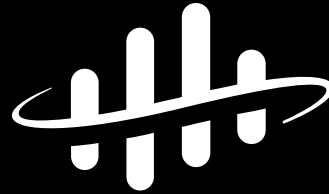
How much time do our data scientists spend finding and cleaning big datasets? How often do they succeed in deploying models into production?

**4. DO WE DEPLOY SOLUTIONS FAST ENOUGH?**

How long does it take our digital teams to deliver and scale internally developed digital applications? How might improved agility and productivity enhance our business and operations?

With enough high-quality, accessible and understandable data, utilities can tackle these and many other issues. This not only allows them to navigate disruption more smoothly and effectively, but it can also help utilities learn to embrace change as an opportunity to keep learning and growing while providing ever-improved services to their customers.





# COGNITE

Cognite is one of the fastest-growing software providers in the field of industrial digitalization. With 350 employees from more than 40 different countries, our interdisciplinary team combines world-class software competence and deep domain expertise. Cognite's offices include Oslo and Stavanger, Norway; Austin and Houston, Texas; Palo Alto, California; Tokyo, Japan; Vienna, Austria; and Singapore. Cognite was founded to enable heavy-asset industries to generate value from their digital transformations by overcoming the obstacles of data trapped in silos, data type disconnectedness, data quality variance, the chasm between proof-of-concept and production (business value), the rigidity and slowness of legacy software development approaches, and the limited ability to leverage pre-existing data logic and flows.

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# DATAOPS FOR POWER GENERATION:

MANAGE ARCHITECTURE  
COMPLEXITY & ENABLE SCALE  
FOR DIGITAL APPLICATIONS

# INTRODUCTION

Digital transformation in the power industry is not a new concept. For decades, ideas, technology, and resources have poured into digital programs aimed at curtailing the impending pressures caused by decreasing demand, decarbonization, and decentralization of power generation sources. This has resulted in a proliferation of new industrial data that is distributed across organizations and sites, but only truly valuable with contextualization and the proper transformations.

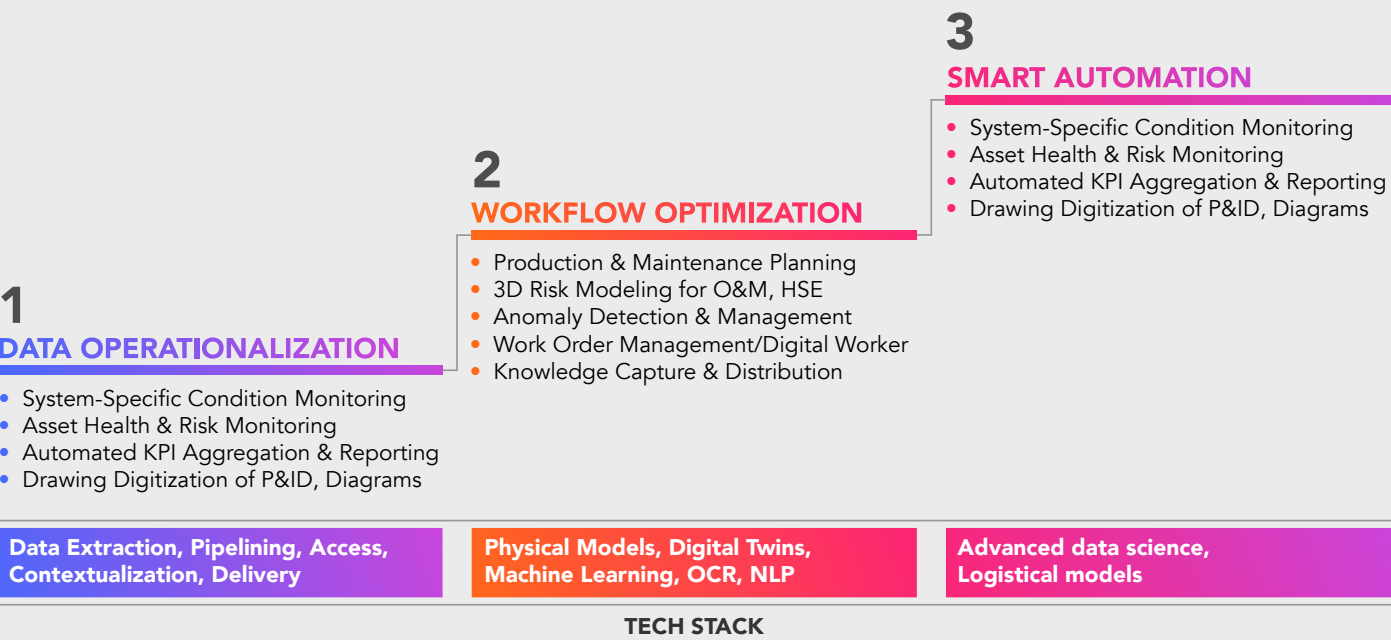
# THE OPPORTUNITY

In light of rapidly aging assets and an experienced operational workforce that is leaving the field, CDOs, Operations, IT, and Citizen Data Scientists are focusing their attention on high-

value applications that maximize operational potential and longevity while reducing costs. Through a targeted deployment of technology-enabled operations, such as workflow optimization, condition-based maintenance, process digitization, and agile working, utilities can increase plant efficiency (heat rate) by up to 3 percent, reduce the average all-in cost of generation (excluding fuel) by 10 to 20 percent for coal and 5 to 15 percent for gas, all while improving safety. <sup>(1)</sup>

- Improving Power Forecasting and Trading Decisions
- Maximizing Operational Visibility Across Sites/Regions
- Streamlining Maintenance Planning and Wrench Time

The individual applications that serve these larger objectives are widespread and can be tiered into three progressive categories of value to the organization:



(1) Unlocking the value of digital operations in electric-power generation, McKinsey & Company, October 2019.

Fig 1: USE CASE PIPELINE

# THE CHALLENGES

However, with so much value potential and the eagerness to explore advanced analytics, AI, and machine learning, industrial data architectures have become increasingly complex, unable to serve data consumers in a dynamic, scalable, and repeatable way. This leads to stalled digital transformation efforts, cost overruns, and inefficient use of human resources, which manifest themselves in the following ways:

These challenges are born out of data architectures that were fundamentally designed for point solutions and not with an open, holistic view that enables data utilization, prototyping, and rapid iteration for a growing portfolio of internal (Data Scientists, SMEs, Analysts) and external (System Integrators, Application Developers) stakeholders. The good news? Inflexible data architectures can be fixed with DataOps and Contextualization.

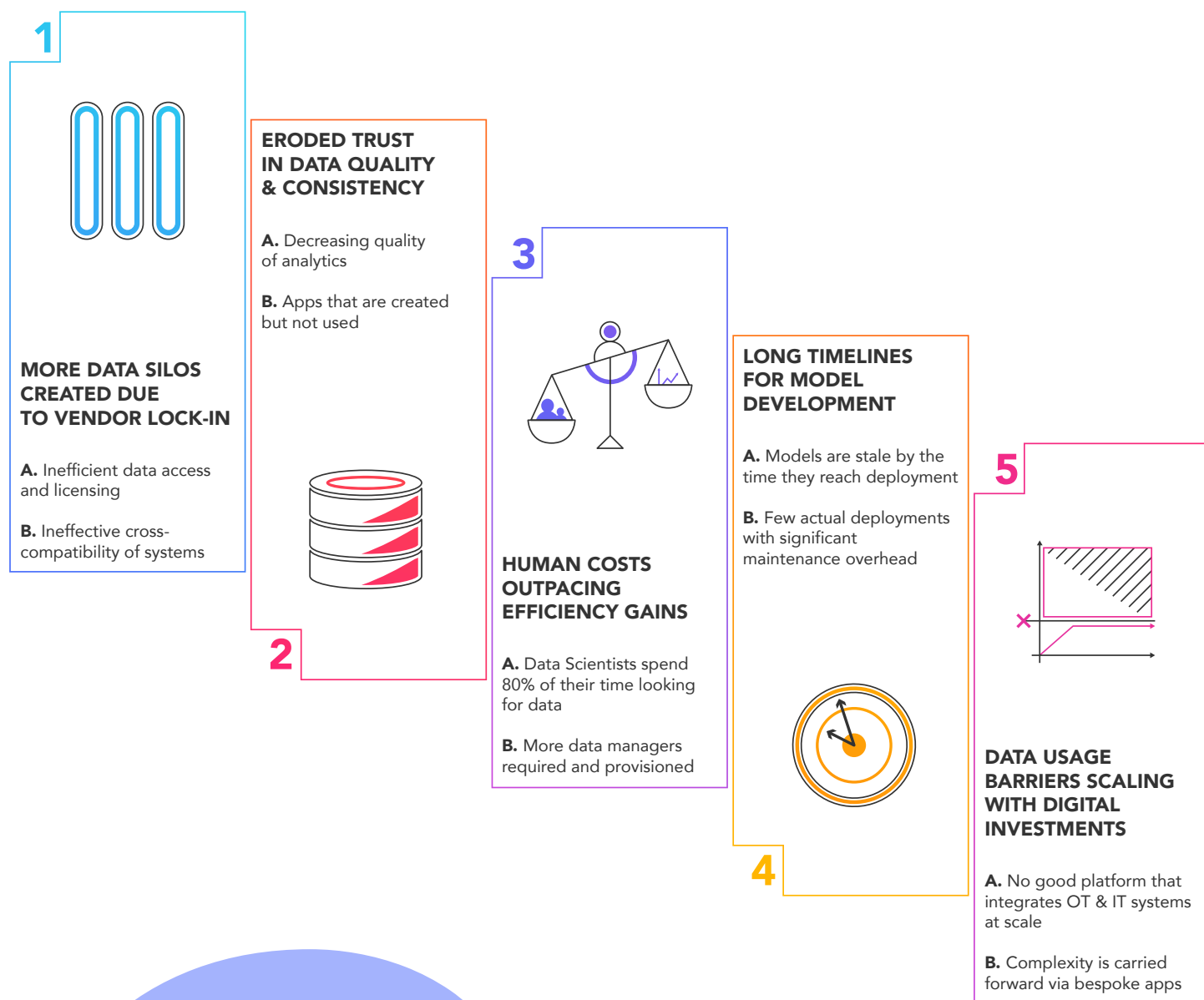


Fig 2: CHALLENGES WITH TRADITIONAL DATA ARCHITECTURES

# THE SOLUTION

## Liberate Your Data with DataOps and Contextualization

The fastest path to returning value starts with *getting the right data to the right user with the right context for the right problem at the right time*. Said another way, with proper DataOps, your data becomes searchable and easily accessible for developers, data scientists, and third-party applications.

### What is DataOps?

A collaborative data management practice focused on improving the **communication**, **integration** and **automation** of data flows between data managers and consumers across an organization.

The goal of DataOps is to create **predictable delivery** and **change management** of data, data models and related artifacts.

DataOps uses **technology** to automate data delivery with the appropriate levels of security, quality and metadata to improve the use and value of data in a dynamic environment.

The secret to successful DataOps programs lies in investing in data contextualization. It is in this layer of the stack where meaningful relationships between data sources and types are established. This enables nonsubject-matter experts to be able to use that data for their projects. For example, turbine sensor tags and hierarchy may not make sense to analysts outside of the maintenance domain, but with proper context and mapping to P&IDs, the information becomes intuitive to nontechnical users for rapid application and model development at scale.

## Cognite Delivers DataOps & Contextualization Through Cognite Data Fusion

Born from industry, Cognite offers Cognite Data Fusion (CDF) to support data consumers with highly accessible, relevant, and contextualized data from both OT and IT data sources across their organization. This empowers users to leverage AI & ML toolkits and low-code development frameworks to scale projects that are already in place or dramatically reduce the overhead and services required for new ones and quickly bring business value back to their organizations. [Learn More](#)

## Cognite Data Fusion Benefits

1. Expands the breadth of applications that can be developed internally or with partners
2. Empowers internal development teams with self-service APIs & SDKs
3. Accelerates app development and time to value with a robust data model



4. Expands app lifecycle and sustainability with rich data pipelining and aggregation
5. Democratizes embedded subject-matter expertise with data access and contextualization

## Cognite Data Fusion Stands Apart from Other Data Management Vendors

- IT & OT Data Contextualization
- 3D & Unstructured Data
- Open Frameworks & Toolboxes
- Hybrid AI
- Digital End-to-End Solutions
- Performance and Scale

## Cognite Data Fusion is already delivering real value to industrial customers

**Case 1:** DataOps enabled Hafslund E-CO to optimize turbine startup sequences, reducing downtime and enabling a more efficient response to fluctuating grid demand. [Read More](#)

**Case 2:** Cognite Data Fusion contextualized operational data from four different Aker BP source systems into a unified dashboard, saving 15 hours weekly on maintenance review of critical equipment. [Read More](#)

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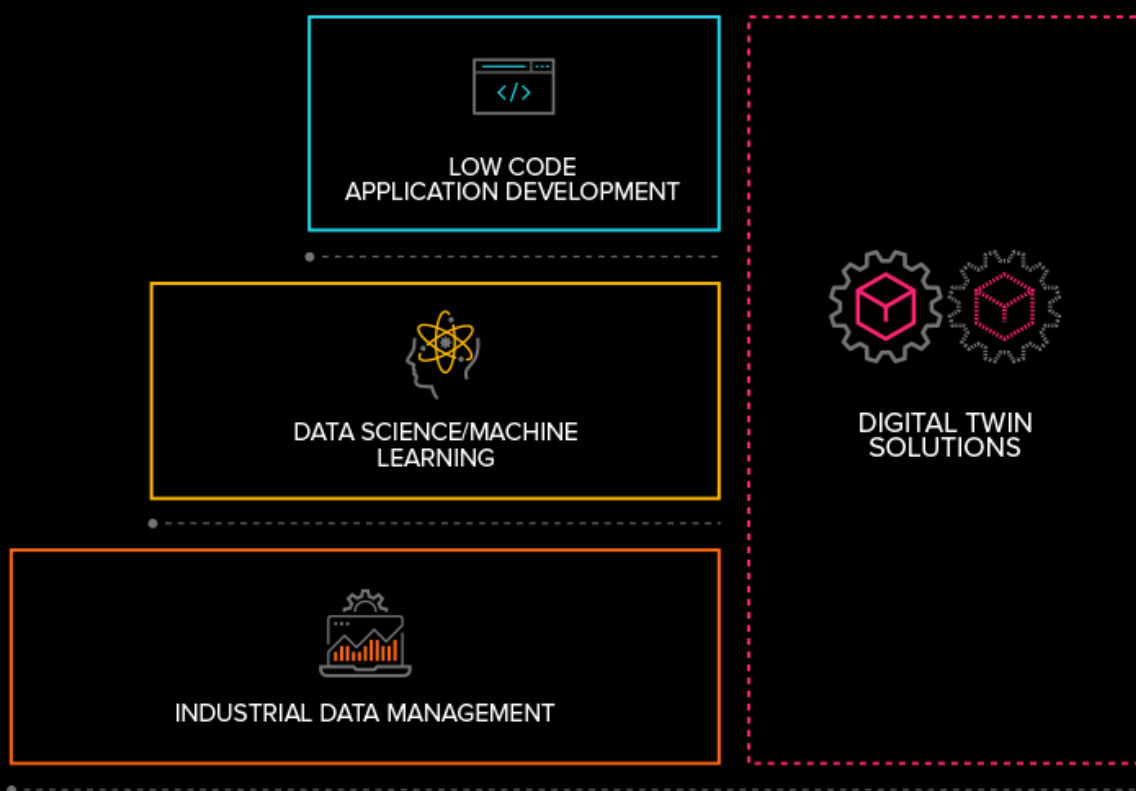


Fig 3: DATAOPS WITH COGNITE DATA FUSION

# ALL ABOUT COGNITE

AUSTIN

HOUSTON

STAVANGER

OSLO

VIENNA

## Our Company

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## Our Mission

At Cognite, we make industrial data more valuable than ever. Empowering users with contextualized data as a service, delivering industrial AI at scale to unlock the power and value of your data.

The key to industrial digitalization lies in data liberation. Heavy-asset industries already have data. Now they need software to collect, clean, and put it to use. A resource to transform the data into information and stimulate a thriving ecosystem of industrial applications.

Embrace change and take control of your industrial transformation opportunity today. Empower your industrial data consumers to build, operationalize, and scale both models and applications with Cognite Data Fusion, the leading industrial DataOps software.



Solution Architects  
& Marketing

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TOKYO

**A Unique  
Global Team  
that Combines  
Software with  
Deep Industry  
Expertise**

**10+** Olympiad medalists  
in International Informatics  
**15%** PhDs

 Microsoft  Apple  Google

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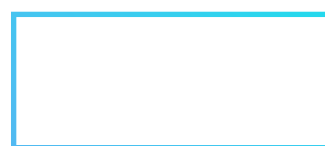
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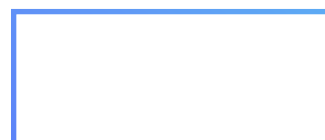
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# DELIVER VIRTUAL OPERATIONS FOR POWER AND UTILITIES WITH COGNITE DATA FUSION

**Maintain Operational Excellence • Increase Productivity and HSE • Adapt to Changing Workflow**

Given major technological advancements in sensing and communications, ongoing objectives to meet HSE goals, and the need to further optimize operations and maintenance (O&M) activity, the power and utilities industry is primed for adopting virtual operations. This transition and urgency continues to accelerate as skilled labor leaves the field and the industry shifts to working in a post-pandemic era. But realizing virtual operations at scale and unlocking ROI continues to be challenging due to the sheer underlying complexity

of accessing and efficiently using data to make better O&M decisions. In some cases, control systems may still use analog components and alerts, making data access impossible. In other cases, new sensing systems must be integrated with legacy data systems, creating a mismatch of databases, protocols, and standards. All in all, achieving virtual operations first means solving fundamental problems with big, messy industrial data.

## Achieving the Unmanned Virtual Power Plant with Data Operations and AI

In order to truly virtualize, operators must be able to combine inspection data (such as video, audible, LiDAR, gas detection, thermal imaging, etc.) with existing data from control systems, CMMS, and ERPs. This requires data aggregation and contextualization in order to create a functional data model that can be used for advanced analysis. With visual data quality and volume, for example, computer vision can be used to identify visual anomalies in image data or

read and process remote analog dials, meters, and displays. Lastly, the analysis output must be made usable by subject-matter experts and field teams through user-friendly, high-fidelity 3D visualizations and digital twins where all known data (from the data model) can be overlaid on alerts and points of interest. Doing this effectively and at reasonable cost and overhead requires a comprehensive platform for Data Operations (DataOps) and AI.



Leverage Robotic sensing for Inspection capture



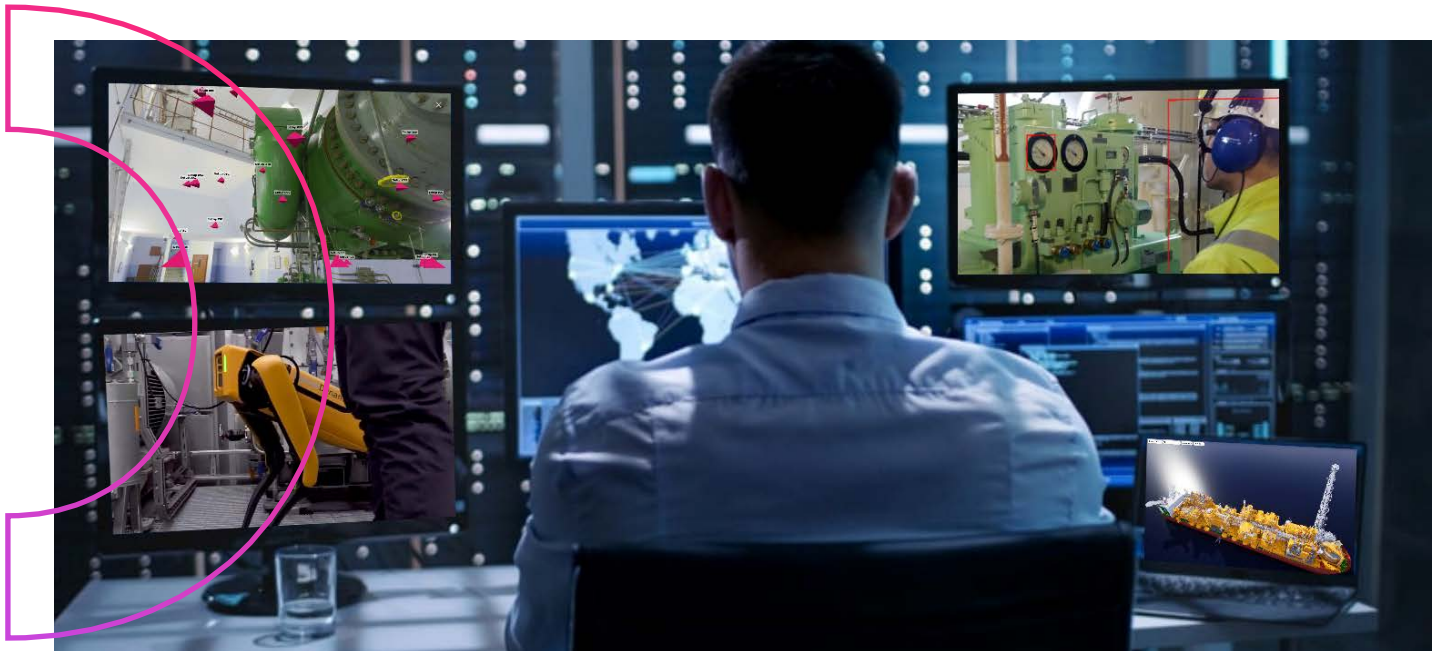
Seamless Integration with SCADA & Control System Data



Assisted Data Analysis With Computer Vision



Visualization Through Digital Twins and 3D Renderings



**Cognite Data Fusion** is the leading industrial data foundation that makes traditionally siloed data available, usable, and contextualized so that operators can efficiently operationalize their data and analysis to achieve remote operations. CDF:

- Aggregates and contextualizes big data from robotics and all available IT and OT data sources
- Empowers data scientists, engineering, domain experts, and analyst workflows
- Enables operationalization and scaling of digital applications with open integrations (APIs/SDKs)
- Ensures data quality and lineage throughout the development pipeline and into the end application

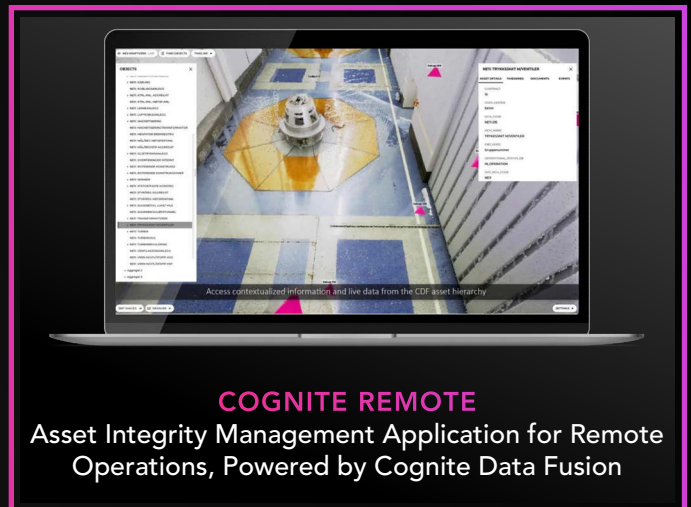
### **Cognite Data Fusion is Extensible with Robotics Hardware and Off-the-Shelf Applications**

Together, Cognite and Boston Dynamics offer next-generation hardware and software so that operators can accelerate their journey towards realizing safer, flexible, efficient remote operations.



#### **SPOT BY BOSTON DYNAMICS**

Automated Sensing and Inspection Platform, Ingested and Contextualized by Cognite Data Fusion



#### **COGNITE REMOTE**

Asset Integrity Management Application for Remote Operations, Powered by Cognite Data Fusion



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