# **Deloitte.**



# Deloite

## About the Deloitte Al Institute

The Deloitte AI Institute helps organizations connect all the different dimensions of the robust, highly dynamic and rapidly evolving AI ecosystem. The AI Institute leads conversations on applied AI innovation across industries, with cutting-edge insights, to promote human-machine collaboration in the "Age of With."

The Deloitte AI Institute aims to promote the dialogue and development of artificial intelligence, stimulate innovation, and examine challenges to AI implementation and ways to address them. The AI Institute collaborates with an ecosystem composed of academic research groups, start-ups, entrepreneurs, innovators, mature AI product leaders, and AI visionaries, to explore key areas of artificial intelligence including risks, policies, ethics, future of work and talent, and applied AI use cases. Combined with Deloitte's deep knowledge and experience in artificial intelligence applications, the Institute helps make sense of this complex ecosystem, and as a result, deliver impactful perspectives to help organizations succeed by making informed AI decisions.

No matter what stage of the AI journey you're in; whether you're a board member or a C-Suite leader driving strategy for your organization, or a hands on data scientist, bringing an AI strategy to life, the Deloitte AI institute can help you learn more about how enterprises across the world are leveraging AI for a competitive advantage. Visit us at the Deloitte AI Institute for a full body of our work, subscribe to our podcasts and newsletter, and join us at our meet ups and live events. Let's explore the future of AI together.

www.deloitte.com/us/AlInstitute

# What's inside



Introduction



Top use cases in Energy, Resources & Industrials

After decades as science fiction fantasy, artificial intelligence (AI) has made the leap to practical reality and is quickly becoming a competitive necessity.



## 03 Emerging use cases in Energy, Resources & Industrials



04

Conclusion

# Introduction

After decades as science fiction fantasy, artificial intelligence (AI) has made the leap to practical reality and is quickly becoming a competitive necessity. Yet, amidst the current frenzy of AI advancement and adoption, many leaders and decisionmakers still have significant questions about what AI can actually do for their businesses.

This dossier highlights several of the most compelling, business-ready use cases for AI in Energy, Resources & Industrials. Each use case features a summary of the key business issues and opportunities, how AI can help, and the benefits that are likely to be achieved. The dossier also includes several emerging AI use cases that are expected to have a major impact on the industry in the future.

Of course, the best uses for AI vary from one organization to the next, and there many compelling use cases for AI beyond the ones highlighted here. However, reading through this collection should give you a much clearer sense of what AI is capable of achieving in a business context—now, and over the next several years—so you can make smart decisions about when, where, and how to deploy AI within your own organization (and how much time, money, and attention you should be investing in it today).



**Nitin Mittal US AI Co-Leader** Deloitte Consulting LLP



**Irfan Saif** US AI Co-Leader Deloitte Risk & Financial Advisory

## Six ways that AI creates business value

Example

Looking across all AI use cases, there are generally six major ways that AI can create value for a business:<sup>1</sup>



## **Cost reduction**

Applying AI and intelligent automation solutions to automate tasks that are relatively low value and often repetitive, can reduce costs through improved efficiency and quality.

### Example

Automating data entry and patient appointment scheduling using natural language processing.



## **Transformed** engagement

Changing the way people interact with technology, enabling businesses to engage with people on human terms rather than forcing humans to engage on machine terms.

#### Example

Using conversational bots that can understand and respond to customer sentiment to address customer needs more effectively. Example



## Speed to execution

Reducing the time required to achieve operational and business results by minimizing latency.

Accelerating the process of drug approval by using predictive insights to create a synthetic trial.

## **Reduced complexity**

Improving understanding and decision making through analytics that are more proactive, predictive, and able to see patterns in increasingly complex sources.

## Example

Reducing factory downtime by predicting machinery maintenance needs.



## **Fueled** innovation

Redefining where to play and how to win by using AI to enable innovative new products, markets, and business models.

Recommending new product concepts and features based on customer needs and preferences mined from social media.

## **Fortified trust**

Securing a business from risks such as fraud and cyber—improving quality and consistency while enabling greater transparency to enhance brand trust.

## Example

Identifying and anticipating cyber attacks before they occur.





# Top use cases in Energy, **Resources & Industrials**

Al adoption and deployment seem to be less extensive and mature in Energy, Resources & Industrials (ER&I) than in most other industries.

So far, there have been fewer big AI success stories in ER&I—and thus less competitive pressure to take immediate action. Although most ER&I companies generally acknowledge the importance of Al—and see it is an essential and disruptive capability that could greatly affect their ability to operate and compete in the future—most efforts to date have been limited to small-scale pilots and proofs-of-concept focused on narrow parts of the business.

The main challenges to increased AI adoption and deployment largely revolves around data. Unlike many other industries where digital data plays a central role, ER&I still revolves around physical work and physical assets—with many of those assets geographically scattered and disconnected from digital networks. Widespread deployment of IoT-related technologies is starting to fill this data void. However, in order to be useful, the resulting data needs to be organized, captured, and analyzed in a timely manner. Also, edge computing and edge AI technologies should be harnessed to enable timely processing and analysis of data in dispersed locations at the edge of the network.

For most ER&I companies, the immediate and important next step is to establish an internal team with expertise in AI, data science, and data engineering to serve as a focal point for all AI-related activities and investments. This team would coordinate Al activities across the company's business ecosystem, while providing a core set of internal AI resources and capabilities that can be supplemented from the outside as needed. Also, the team would provide a broad, balanced, and informed perspective on using AI across the enterprise.

Too many AI initiatives and visions in ER&I are either overly tactical and technical (too narrowly focused, and often highlighting technical capabilities that are exciting but not very useful), or overly strategic and ambitious (too difficult and expensive to implement, requiring data and advanced capabilities

that don't currently exist). To succeed with AI, ER&I companies should have strategies and roadmaps based on a practical understanding of what parts of the business are best suited for Al.

One early and ongoing focus area for AI in ER&I is making machine maintenance more predictive and less reactive. Another key focus area that is getting a lot of traction these days is using AI to improve interactions with customers and field workers. Also, some ER&I companies are starting to explore the use of Al to help them handle extreme weather and other hard-to-predict events. By harnessing the power of AI vision and other advanced Al technologies, companies can monitor and analyze vast amounts of informationincluding data from field sensors, drone video, and weather radar—with a level of timeliness. accuracy, and thoroughness that humans alone simply cannot achieve.

Expanding on the idea of machines helping humans be more efficient and effective, Al's single biggest impact in ER&I could be helping companies address the future workforce gap. The Biden administration's multi-trillion dollar commitment to infrastructure is expected to dramatically increase business activity throughout ER&I, but could also create a significant shortage of workers and expertise. AI can help address this gap by augmenting the work done by humans—doing much of the preparatory analysis and heavy lifting so human workers can focus on activities that require skills and expertise that are uniquely human.

## **Keeping downtime down** (Predictive Machine Maintenance)

Use AI to optimize industrial machine performance, predict failures, and inform maintenance requirements with IoT-powered asset monitoring.

## **Issue/Opportunity**

Machine maintenance is typically a significant source of cost savings, as the cost of unplanned downtime for industrial manufacturers is approximately \$50 billion annually.<sup>2</sup> Preventative maintenance for plant assets has traditionally relied on mean-timeto-failure to determine when maintenance should be scheduled (with breakdowns and failures noted in service logs to analyze historical performance). However, with the industrial IoT market growing and IoT sensors becoming ubiquitous in factories industrial manufacturers now have a valuable opportunity to use IOT data and AI to make smarter decisions about when machines should be serviced or replaced, helping factories maximize production output at lower cost.

## How AI can help

- Better predict and plan for necessary maintenance and downtime. By monitoring machines and collecting feedback data in real time, AI technologies can analyze patterns for each machine to determine its actual maintenance needs and create a customized schedule that minimizes overall downtime on the factory floor. Also, as historical data is collected and analyzed, AI can help factory managers be increasingly proactive in scheduling downtime for maintenance.
- Proactively identify and fix hidden quality problems. Over time, AI can learn to recognize patterns in IoT sensor data to identify which machine parts are most likely to fail. These results can be further analyzed to understand the correlation between critical parts' performance and the quality of product output. Armed with these Al-driven insights, factory managers can be more informed and precise about the parts for which they request maintenance, and can even provide feedback to help equipment manufacturers improve critical parts that fail frequently.

## **Possible benefits**



#### Lower maintenance costs.

Maintenance on plant assets remains a significant cost today, even with current best-in-class preventative maintenance measures. AI can enable a new level of maintenance efficiency and cost savings.



## Proactive maintenance and reduced downtime.

As IoT sensors become ubiquitous, the resulting troves of sensor data can be analyzed to better understand patterns in machine performance and critical points of failure, helping factory managers schedule downtime more proactively while reducing maintenance and labor costs.

## Al at the edge (Edge AI for Production and Planning)

Use IoT solutions based on Edge AI to streamline production and planning processes—and to reduce unexpected downtime.

## **Issue/Opportunity**

The IoT market is expected to reach \$2.4 trillion by 2027,<sup>3</sup> with adoption eminent for companies in IoT-heavy ER&I sectors. This breathtaking growth would enable a sharp increase in the volume and sophistication of data collection and actionable insights at factory, asset, and industrial endpoints. Higher data volume leads to increased latency, and can greatly increase the need for processing power and security at the edge of the network. To handle all of this new IoT data—and to process it in a timely and efficient manner-companies should consider IoT solutions that harness the power of edge computing and Al.

## How Edge AI can help

• *Run advanced computing algorithms at the edge* of the network. Compact, GPU-enabled deep learning acceleration platforms (such as the DLAP x86 series) make it possible to run advanced computing algorithms without using cloud data storage or external computing systems.

## **Possible benefits**





## Competitive advantage.

In the race for insights and innovation, companies need IoT solutions that can deliver sophisticated analysis quickly and efficiently at the edge of the network.



Timely, actionable insights at lower cost. Edge AI can provide a path to make the growing amount of IoT sensor data actionable for analysis at greater speeds and lower costs than traditional IoT technologies.

- *Improve data security*. Locally storing and processing data on edge devices can reduce the number of security vulnerabilities and can eliminate the need for third-party data storage solutions, which can be susceptible to cyberattacks.
  - Make IoT solutions less costly and more efficient. By eliminating the need for cloud storage and processing, Edge AI technology is typically much more cost effective than traditional IoT solutions, which require companies to account for the cost of storage in addition to the cost of hardware devices and network bandwidth.
  - Enable faster decision making. Faster data intake and AI processing at the edge enables complex decisions to be made quickly. For example, the time required to create geo-models for oil well placement can be reduced from months to hours by aggregating historical data, real-time sensor data, and geological models—all at the edge.



Improved operational efficiency with less downtime. Edge AI enables dozens of focused ER&I use cases that can streamline operational decisions and reduce unplanned downtime.

## Making sense of sensor data (Field Sensor Data Analysis)

Use AI technologies to analyze real-time data from networks of sensors in the field (combined with scientific knowledge models and information about various environmental/ peripheral factors such as seismic activity, drilling logs, cores, completion designs, production data, and maintenance records).

## **Issue/Opportunity**

The multidisciplinary nature of downstream oil and gas operations requires analysis of real-time sensor data combined with scientific knowledge models. Similarly, upstream energy operations require intensive analysis of complex and unstructured data—such as spatial, geological, geophysical, and chemical data—to monitor production assets and assess opportunities for exploration and drilling.

Rising amounts of data from smart sensors and other imaging technologies are creating an opportunity for AI to generate insights from complex, hidden patterns that are impractical or impossible for humans to analyze. However, uniform data standards do not currently exist to help analyze this wide variety of data. Also, existing processes for analyzing and interpreting the data are time intensive and can have unintended outcomes that pose significant financial and safety risks.

## How AI can help

- *Monitor field assets in real time.* Downhole sensing technologies such as fiber optics can transmit a huge amount of real-time data to inform how oil wells and pipelines are performing. Through anomaly detection and predictive modeling, this data can be quickly analyzed to alert operations about leaks or malfunctions—and to forecast daily gas production from wells.
- Identify and assess opportunities for exploration. Sophisticated systems, such as cognitive discovery platforms, can combine geologic data from field sensors with existing public and private databases and scientific models to create knowledge graphs. Machine learning algorithms can then be applied to these knowledge graphs to identify opportunities for hydrocarbon exploration and assess the associated financial risk.

## **Fielding questions from the field** (Field Workforce Support and Safety)

Use AI technologies such as natural language processing (NLP) to give field workers easy access to critical information. Also, use computer vision and machine learning algorithms to sense dangerous working conditions and automatically generate alerts.

## **Issue/Opportunity**

Given the risky and complex nature of oil and gas field work, repairmen, rig workers, and operators need timely, around-the-clock access to reliable information and support while on the job. Currently, most oil and gas workers rely on human-staffed call centers for information and emergency assistance. However, those call centers are costly to run 24/7, and do not provide consistently high levels of service.

Increased pressure to lower production costs while boosting efficiency is prompting oil and gas companies to consider using AI technologies such as natural language processing (NLP) and machine learning (ML) to augment or replace humans in call centers and other essential overhead functions.

## Possible benefits



### Improved monitoring and forecasting.

Applying AI techniques, such as anomaly detection algorithms and machine learning to field sensor data, can improve production asset monitoring and performance forecasting.



**More confident exploration.** Analyzing field sensor data with AI can provide a higher degree of confidence throughout the exploration process.

## **Possible benefits**



**More timely and reliable access to critical information.** For field workers who need real-time access to critical information, AI technologies can provide answers, alerts, and insights in a more accessible and accurate manner than traditional call centers.

## How AI can help

- Consolidate structured and unstructured data from multiple sources. Smart AI Assistant platforms can combine internal enterprise data with publicly available information from multiple sources in a wide range of formats, including: documents, spreadsheets, presentations, web pages, emails, and APIs.
- Provide field workers with easy access to information. Field workers looking for targeted answers can access the consolidated data through web portals, mobile apps, messaging conversations, and smart speakers.
  - Support various use cases with conversational AI. Conversational AI can support field workers by applying natural language processing (NLP) to their information requests and then querying a consolidated database of internal and external data to fetch the requested information. Typical uses in oil and gas include on-the-fly requests for: safety guidelines; real-time statistics on well operation; details from meetings and emails; and business insights, such as historical and projected operational costs.



**Greater convenience for field workers.** Conversational AI can make it easy for workers to request information through a variety of field-friendly devices and channels.

## **Keeping the lights on** (Predictive Insights for Utility Service Outages)

Use AI algorithms and predictive analytics to forecast energy loads and peaks in demand reducing service outages, and providing customers with more accurate timing and duration estimates for outages that cannot be avoided.

## **Issue/Opportunity**

For utilities companies, over-producing energy is costly and wasteful, as is storing energy over long periods of time. However, under-supplying leaves areas vulnerable to service outages during peak hours. Energy consumers increasingly expect a broader array of energy options with greater transparency and lower costs, placing pressure on utilities companies to be more thoughtful about the products and services they offer.

## How AI can help

- Better predict energy demand and outages. Machine learning models can identify historical trends within energy markets to more accurately forecast loads and demand peaks, helping to ensure an adequate supply of energy. Other factors such as weather forecasts, event-based indexes, and supply-side constraints can be included in the models to not only predict demand, but also to predict the length and timing of service outages that cannot be avoided.
- Proactively alert customers about expected outages and resolution times. Customers can benefit from predictive AI when their service providers are better equipped to handle demand peaks and other risk factors such as inclement weather. However, when service outages are unavoidable, predictive AI can also help utilities companies issue warnings to their customers and keep them updated with expected resolution times.

## **Possible benefits**



#### Fewer outages.

Predictive analytics can help utility companies prepare for times of energy strain by considering real-time forecasts and historical data.



## Improved customer service. Accurate predictive insights can improve customer service by enabling early outage warnings and accurate outage duration estimates.



## Reduced operating and maintenance expenses.

With AI, operating expenses (OpEx), such as labor and equipment costs related to outages, can be reduced and/or replaced with capital expenditures (CapEx) for AI technology assets.



# Materials development in record time (Materials Informatics)

## Using AI and data management technologies to accelerate the development of materials and chemicals.

Developing innovative new materials and chemicals has traditionally been a complex, time-consuming process that requires a lot of guesswork, trial and error, and laborious manual research. But thanks to advances in AI, many of those steps are being streamlined or eliminated. The Al-powered process involves building and maintaining a comprehensive database of development data about materials and chemicals—automatically converting technical documents into a structured, searchable database—and then using machine learning and advanced analytics to mine the data and discover high performing compounds in record time. The AI models can predict the performance of new materials, chemicals, and formulations, and can suggest which experiments to run next—helping researchers avoid redundant experiments and quickly find relevant data sets. The potential? Developing new chemicals and materials at unprecedented speed.

Emerging AI use cases in Energy, Resources & Industrials



Emerging AI use cases in Energy, Resources & Industrials

# Smarter supply chains (Algorithmic Supply Chain Planning)

## Using AI to improve supply chain transparency, optimize transportation routes, and minimize delivery disruptions.

The COVID pandemic vividly illustrated the devastating impact that unexpected events can have on global supply chains. Thankfully, AI can help the world avoid similar disruptions in the future. By crunching through the massive amounts of data being generated by today's supply chains, Al can predict a wide range of unexpected events—such as weather shocks, transportation bottlenecks, and labor strikes—helping to anticipate problems and reroute shipments around them. Al can also enable dramatic improvements in other key supply chain areas, including demand forecasting, risk planning, supplier management, customer management, logistics, and warehousing. The potential results? Improved operating efficiency and working capital management; greater transparency and accountability; more accurate delivery estimates; and fewer supply disruptions.



# A digital sandbox for manufacturing (Digital Twin Factory)

Using sensor data and AI to create and analyze digital models of real-world machines and factories enabling operations to be improved without disrupting production.

Trying to optimize a manufacturing operation without disrupting production can be like trying to change the tires on a race car while it's zooming around the track at 200 miles per hour. The solution? An AI-enabled "digital twin." A digital twin is a virtual representation of a physical device or system that mirrors its exact elements and behavior in real time. Sensor data from numerous sources—along with historical data—is combined with machine learning and advanced analytics to create digital models and spatial graphs that constantly match the status, position, and working condition of their physical counterparts. These exact digital simulations enable a company to conduct extensive analysis and optimization experiments without disrupting day-to-day operations. It's a virtual process that can deliver real-world benefits.

Emerging AI use cases in Energy, Resources & Industrials

Emerging AI use cases in Energy, Resources & Industrials

# Avoiding industrial disasters

(Virtual Plant Operator Assistant)

## Using AI to help plant operators perform their jobs more effectively with less risk of catastrophic errors.

Traditional plant control systems rely heavily on monitoring from human operators. However, much of the time those operators are sitting around the control room with little or nothing to do, making it easy for them to lose focus or have their skills deteriorate. AI can supplement operators' capabilities, helping them make better decisions and avoid human error—especially in critical situations where stress levels might be off the chart and every second counts. In concept, this is similar to vehicle-related AI capabilities such as autonomous driving and lane assist that are designed to help people function more safely and effectively, but applied to complex industrial activities that are much less common—and that have much greater potential for serious consequences (such as a chemical explosion or nuclear meltdown). In critical situations like these, operators would need all the help they can get—particularly from AI, which is immune to pressure and stress.

> Al can supplement operators' capabilities, helping them make better decisions and avoid human error—especially in critical situations where stress levels might be off the chart and every second counts.

The Energy, Resources & Industrials AI Dossier | By Deloitte AI Institute

# The key to success is to start small but think big.

# Conclusion

Although AI adoption rates and maturity levels vary widely across industries—and even within them there seems to be no question that AI is here to stay. In fact, AI is quickly becoming a competitive necessity for nearly all types of businesses—driving unprecedented levels of efficiency and performance and making it possible for businesses of every shape and size to do things that simply weren't possible before.

The key to success is to start small but think big. According to a recent Deloitte survey—State of Al in the Enterprise, 3rd Edition—74 percent of businesses surveyed are still in the AI experimentation stage with a focus on modernizing their data for AI and building Al expertise through an assortment of siloed pilot programs and proofs-of-concept, but without a clear vision of how all the pieces fit together. By contrast, only 26 percent of businesses surveyed are focused on deploying high impact AI use cases at scale, which is when the real value kicks in.

In this compendium, we've highlighted many of the most compelling and business-ready use cases in every major industry. However, a use case is only as good as the extent to which it is actually used. No matter how compelling an AI use case might seem on paper, its full value can only be unlocked if you embrace and deploy it at scale across your broader enterprise and ecosystem.



Dera

**Beena Ammanath** 

**Executive Director of the Deloitte AI Institute** Deloitte

17

# Contact us

# Acknowledgements

Our insights can help you take advantage of chance. If you're looking for fresh ideas to address your challenges, we should talk.



**Stanley Porter US Energy, Resources & Industrials** Industry Leader, Vice Chair Deloitte Consulting LLP

Kathryn Pavlovsky

sporter@deloitte.com



US Risk & Financial Advisory Energy, **Resources & Industrials Industry** Leader, Principal Deloitte Risk & Financial Advisory kpavlovsky@deloitte.com

## **Reid Miller**

Principal

## **US Consulting Energy, Resources** & Industrials Industry Leader,

Deloitte Consulting LLP remiller@deloitte.com



Nitin Mittal **US AI Co-Leader** Deloitte Consulting LLP nmittal@deloitte.com



**Irfan Saif US AI Co-Leader** Deloitte Risk & Financial Advisory isaif@deloitte.com

**Beena Ammanath Executive Director of the Deloitte Al Institute** Deloitte bammanath@deloitte.com

Deloitte Al Institute leadership expresses their deep gratitude to the following for their contributions to the development of this report (in alphabetical order): Adnan Amjad, Stephen Batson, Adam Berman, Valeriy Dokshukin, Ramsey Hajj, Jerry Johnston, Mike Kosonog, Clark Oeler, Nirav Parikh, Sean Peasley, Rick Perez, and Charlie Sanchez.

Deloitte Al Institute leadership also expresses their appreciation for the support that made this report possible (In alphabetical order): Lisa Beauchamp, Rameeta Chauhan, Caroline Chen, Bethany Donato, Karishma Gupta, Stephen K. Lee, Greg Lerner, Lori Lewis, Parker Lytle, Raghav Nyati, Jamie Palmeroni-Lavis, Meredith Parker, Tracey Parry, Manasi Patel, Jacinta Pope, Raksha Raghunath, Vignesh Ramakrishnan, Kate M. Schmidt, Christine Svitila, and Christina Scoby.

## Endnotes

- 1. Source: Deloitte analysis
- 2. "Unlocking Performance," IndustryWeek in collaboration with Emerson, accessed August 16, 2021.
- 3. "The Internet of Things, 2020," Business Insider, March 6, 2020.



This communication contains general information only, and none of Deloitte Touche Tohmatsu Limited, its member firms, or their related entities (collectively, the "Deloitte Network") is, by means of this communication, rendering professional advice or services. Before making any decision or taking any action that may affect your finances or your business, you should consult a qualified professional adviser. No entity in the Deloitte Network shall be responsible for any loss whatsoever sustained by any person who relies on this communication.

#### About Deloitte

About Deloitte Deloitte refers to one or more of Deloitte Touche Tohmatsu Limited, a UK private company limited by guarantee ("DTTL"), its network of member firms, and their related entities. DTTL and each of its member firms are legally separate and independent entities. DTTL (also referred to as "Deloitte Global") does not provide services to clients. In the United States, Deloitte refers to one or more of the US member firms of DTTL, their related entities that operate using the "Deloitte" name in the United States and their respective affiliates. Certain services may not be available to attest clients under the rules and regulations of public accounting. Please see www. deloitte.com/about to learn more about our global network of member firms.