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The Energy, Resources & Industrials AI Dossier

A selection of high-impact use cases

The Deloitte AI Institute™

About the Deloitte AI Institute

The Deloitte AI Institute™ helps organizations connect all the different dimensions of the robust, highly dynamic, and rapidly evolving Artificial Intelligence 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 AI, 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, the 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, delivers impactful perspectives to help organizations succeed by making informed AI decisions.

No matter what stage of the AI journey you are in: whether you are 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/AIInstitute

Foreword

Artificial intelligence (AI) continues to advance by leaps and bounds, delivering breathtaking capabilities once thought to be far off in the future. With a remarkable capacity to understand complex inputs and generate valuable outputs—and the rapidly emerging ability to execute real-world actions—AI is opening the door to innovations and new ways of working that were almost unthinkable just a few years ago.

As the AI landscape evolves, so does this compendium. Our latest edition features 86 of the most compelling use cases for AI across six major industries:

- **Consumer**
- **Energy, Resources & Industrials**
- **Financial Services**
- **Government & Public Services**
- **Life Sciences & Health Care**
- **Technology, Media & Telecommunications**

For each of these industries, we explore innovative uses for AI that can address enterprise challenges in new ways, expand and improve capabilities in every business function, and deliver advantages in efficiency, speed, scale, and capacity. To provide further context and clarity, each case specifies the primary business function it supports and whether agentic AI is used. These labels are presented for informational purposes, helping you quickly grasp the intention and scope of each case.

Of course, every powerful tool presents potential risks, and AI is no exception. To help you better understand and manage the risks associated with AI, we use Deloitte's Trustworthy AI™ framework throughout this compendium to illuminate factors that contribute to trust and ethics in AI deployments, and to offer practical steps for strengthening governance and risk mitigation. The specific objective of our Trustworthy AI™ framework is to help organizations create AI systems that are (1) fair and impartial, (2) robust and reliable, (3) transparent and explainable, (4) safe and secure, (5) responsible and accountable, and (6) private.

Given AI's rapidly expanding scope and reach, this compendium offers just a glimpse of what the technology can do. Our goal is to convey what AI is currently capable of, and even more important, to inspire the next wave of AI-driven innovation. As AI technology continues to improve and organizations increasingly embrace it, we anticipate even more impressive and compelling use cases in the future—including those that have yet to be imagined.

We hope the use cases highlighted here will spark new ideas, provide a foundation for successful deployments, and set organizations on a path to harness the maximum value from this powerful new technology.

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The Energy, Resources & Industrials AI Dossier

AI is emerging as a critical enabler of transformation across the energy, resources, and industrial sectors. In industries defined by asset intensity, operational complexity, and margin pressure, AI offers the ability to sense, predict, and act with speed and precision. From optimizing energy production and forecasting demand to predicting equipment failures and supporting engineers in the field, AI is helping organizations operate more efficiently, safely, and sustainably.

Recent advances—particularly in industrial-grade machine learning, computer vision, and autonomous control systems—are expanding the frontiers of what's possible. AI agents can now manage assets and oversee field operations with minimal human input. Meanwhile, generative models are being used to simulate physical systems, accelerate engineering design, and fine-tune operational planning.

These capabilities are arriving at a critical moment. Energy, resources, and industrials companies face mounting pressure to decarbonize, digitize, and build resilience in the face of global volatility. AI can support these goals by unlocking more value from existing assets, enabling predictive and prescriptive analytics, and surfacing hidden efficiencies in large-scale operations. Integrating real-time data from sensors, satellites, and enterprise systems, AI can offer decision-makers a more holistic, adaptive view of their operations.

However, realizing this potential requires more than model development. It demands robust infrastructure, workforce upskilling, data governance, and alignment with regulatory frameworks—particularly as AI applications begin to intersect with safety-critical systems. Companies that take a disciplined, value-focused approach to AI adoption are already seeing meaningful returns, from reduced downtime and energy waste to faster innovation cycles.

In industries defined by asset intensity, operational complexity, and margin pressure, AI offers the ability to sense, predict, and act with speed and precision.

As capabilities mature, AI is set to become not just a tool for operational excellence in the energy, resources, and industrials sectors, but a cornerstone of competitiveness in an increasingly automated and resource-constrained world.

Note: *The tags below each use case indicate its primary business function and whether Agentic AI is used.*

Tags | Primary business function | Agentic AI

AI-driven predictive maintenance

Avoiding downtime through autonomous, multi-agent diagnosis and intervention

Agentic AI systems can monitor industrial equipment health, anticipate failures, diagnose root causes, and proactively schedule maintenance—keeping equipment running smoothly and reducing maintenance costs.

ISSUE/OPPORTUNITY

Industrial equipment failure can trigger substantial costs; yet, traditional maintenance is often reactive or rigidly scheduled, leading to unexpected breakdowns or wasteful over-maintenance. Critical factors such as labor shortages, weather events, and the move toward electrification are all increasing the need for AI-powered predictive maintenance of industrial equipment and more dynamic, data-driven asset maintenance planning.

Tags: **Manufacturing & Quality** | **Agentic AI**

HOW AI CAN HELP

Continuous sensor monitoring and anomaly detection

AI agents can analyze vibration, temperature, pressure, and other IoT sensor data in real time, leveraging predictive analytics to flag deviations from baseline performance and predicting impending failures.

Root cause analysis and diagnosis

When anomalies are detected, specialized agents can assess historical failure logs, maintenance records, and environmental conditions to pinpoint likely failure modes.

Automated work order generation and scheduling

Other agents can generate detailed work orders and schedule tasks based on production cycles, resource availability, and cost constraints.

Simulation and reinforcement learning

Multi-agent reinforcement learning systems can simulate inspection intervals and failure scenarios to reduce maintenance expenses and downtime.

Human-centric integration and continuous improvement

AI agents can collaborate with human maintenance teams: presenting findings in clear, natural language, validating outcomes, helping to prioritize alerts and recommend next steps, and refining models over time based on new data and outcomes.

AI-driven predictive maintenance

MANAGING RISK AND PROMOTING TRUST

Robust and reliable

Predictive accuracy should be validated across varied asset types and environmental conditions. Also, AI agents should be tested against historical failure cases and simulated breakdown scenarios, with fall back mechanisms for human review in uncertain situations.

Transparent and explainable

Explainable AI outputs improve adoption and help build trust. Agents need to provide transparent reasoning for their recommendations and actions (e.g., “Vibration on bearing exceeds historical threshold during peak load,” or “Leaf spring failure consistent with past incidents”), supported by traceable data sources.

Safe and secure

Industrial systems are vulnerable to cyber threats, and the consequences of a breach can be severe. Agent platforms should include intrusion detection, secure communication with edge devices, and resilience against malicious sensor tampering or spoofing.

Responsible and accountable

Although AI agents can provide valuable decision support, ultimately human technicians and maintenance managers are responsible for critical decisions and actions. As such, clear escalation protocols need to be established for ambiguous or high-risk alerts.

POTENTIAL BENEFITS

Less unplanned downtime

Real-time, automated detection can trigger repairs early when needed, turning potential disruptions into planned maintenance and reducing productivity losses.

Lower maintenance costs

Focusing on condition-based needs can reduce unnecessary maintenance, minimizing spare-part inventory and technician labor.

Extended asset lifespan and operational efficiency

Continuously monitoring the condition of industrial equipment enables more precise upkeep and longer service life. Data-driven insights improve scheduling and reduce waste, boosting overall productivity and sustainability.

Autonomous drone-based infrastructure inspection

Conducting unmanned, AI-guided inspections of physical assets

Autonomous drones, guided or enhanced by agentic AI, can inspect physical infrastructure such as power lines, pipelines, and transmission towers—capturing and analyzing quality imagery at lower cost and risk.

ISSUE/OPPORTUNITY

Traditional infrastructure inspections in energy, mining, utilities, and industrial environments typically rely on human teams using scaffolding, helicopters, or ropes. In addition to being costly, dangerous, and slow, these manual inspection methods are often disruptive to ongoing operations. What's more, they can miss subtle problems such as hidden defects and weather-related damage.

Autonomous drone systems, especially docked or "drone in a box" variants, enable frequent, hands free inspections that reduce costs, minimize risk to human personnel, and improve overall quality and speed.

Tags: **Field Services** | **Agentic AI**

HOW AI CAN HELP

Automated flight and mission control
Drones launch autonomously from preprogrammed docks, fly designated routes, capture high-resolution imagery, and then return for charging and data offload—all without human pilots.

AI-driven defect detection
Onboard analytics can automatically process visual, thermal, or LiDAR data to highlight problems such as cracks, corrosion, vegetation encroachment, and structural anomalies.

Agentic inspection orchestration
An orchestration agent can oversee fleets of drones, schedule inspection missions dynamically, monitor inspection results in near-real time, and then automatically trigger follow-up maintenance workflows when anomalies are detected. This greatly reduces the need for manual coordination.

Extended-range and precision navigation
Advanced AI systems now support beyond-visual-line-of-sight (BVLOS) operations over long distances using perception-aware controllers to maintain accurate positioning and avoid obstacles.

Autonomous drone-based infrastructure inspection

MANAGING RISK AND PROMOTING TRUST

Robust and reliable	Inaccurate or inadequate inspections can lead to safety risks and failures. Drone systems need to be validated against varied situations and adverse environments, not just routine test missions and historical defect cases. Also, escalation paths should be established for manual review of ambiguous findings.
Transparent and explainable	AI should provide tangible evidence (such as high-resolution images, heat maps, or annotated photos) accompanied by clear explanations that enable maintenance teams to confidently verify issues.
Private	Some drone inspections may inadvertently capture sensitive data. Agents need to enforce data minimization and restricted-access policies to protect private or proprietary information during data collection and transfer.
Safe and secure	Since drones operate near power lines and potentially dangerous industrial equipment, systems must include breach-resistant communication, secure command chains, and rigorous safeguards against signal spoofing or unauthorized control.

POTENTIAL BENEFITS

Safety improvements

Human workers no longer need to climb towers, pilot helicopters, or enter hazardous zones for routine inspections, reducing the risk of injuries.

Cost and operational efficiency

Autonomous drones reduce inspection time and logistics overhead, significantly lowering costs and enabling more frequent monitoring without disrupting operations.

Proactive maintenance and uptime

Higher-frequency missions and more consistent data allow earlier detection of issues. This enables maintenance to be done before failure occurs, reducing unplanned downtime and enhancing asset reliability.

Autonomous field operations management

Improving safety and efficiency by using AI agents to support field operations

Agentic AI systems can improve field operations by managing task coordination and automating frontline decision-making, enabling field workers to focus on complex, high-value activities rather than routine logistics.

ISSUE/OPPORTUNITY

Field operations such as utility maintenance, site monitoring, asset inspection, and emergency response are typically labor-intensive and highly fragmented. Workers in remote locations often face incomplete data, manual task assignments, shifting priorities, and limited coordination. These challenges can slow response times, increase safety risks, and make it harder to scale up operations. AI agents can help address such issues by autonomously handling coordination, data collection, and routine decision-making.

Tags: **Field Services** | **Agentic AI**

HOW AI CAN HELP

Task management and response automation

AI agents can identify operational issues such as inspection gaps, maintenance alerts, and compliance breaches. while also providing real-time support to field teams, bridging the gap between manual and autonomous operations. They can generate task lists, assign them to the right field crews, and follow up on execution, reducing coordination delays and helping to avoid missed maintenance cycles.

Context-aware adaptation

Agents can respond in real time to changes such as weather shifts, unexpected hazards, and shifting regulatory requirements. They can also reschedule tasks, redirect resources, and escalate safety alerts as needed.

Specialist collaboration

Multi-agent AI teams can mimic expert field units. For example, a maintenance agent can diagnose faults; a scheduling agent can reroute technicians; and a compliance agent can confirm actions comply with regulatory requirements. By working together, AI agents can provide specialized yet cohesive action.

Continuous learning and feedback

Agents can learn from experiences such as safety incidents, unexpected site constraints, and real-world repair times. This feedback loop improves their task allocation and decision logic, boosting long-term effectiveness and responsiveness.

Autonomous field operations management

MANAGING RISK AND PROMOTING TRUST

Robust and reliable	Field operations take place in unpredictable environments. Agents should be tested against variable and adverse conditions, such as network outages and natural disasters. Fallback paths should include human intervention for ambiguous cases.
Transparent and explainable	Technicians, supervisors, and regulators need to understand AI decisions. Agents should provide clear rationales such as "rescheduled inspection due to stage-1 weather alert," backed by task logs and field data.
Safe and secure	Safety in field operations is of paramount importance. As such, agentic systems must include cybersecurity safeguards such as encrypted communications, device authentication, anomaly detection, and protection against unauthorized commands.
Responsible and accountable	Governance structures should define escalation paths, sign-off mechanisms, and oversight protocols for AI-generated plans. Although agents can provide useful support, ultimate responsibility for critical decisions and actions should remain with human field supervisors and operations managers.

POTENTIAL BENEFITS

Faster field response

AI agents can close the gap between detection and action by assigning tasks and dispatching crews within minutes of an alert, eliminating unnecessary delays.

Higher operational uptime

Proactive task assignment and adaptive scheduling can help ensure that critical infrastructure remains up and running, minimizing downtime and safety disruptions.

Scalable field capacity with fewer resources

AI agents can help smaller teams effectively manage larger service areas, expanding operational reach without requiring proportional staffing increases.

Intelligent commercial operations

Driving smarter bidding, pricing, and customer engagement with AI agents

AI can streamline and accelerate commercial operations by using agents to automate contract pricing, bid preparation, demand forecasting, and customer engagement workflows.

ISSUE/OPPORTUNITY

Commercial teams in the energy, resources and industrial sector face complex pricing challenges across multiple product lines, geographic regions, and regulatory regimes. Traditional methods are labor-intensive and revolve around spreadsheet models and fragmented data sources. This highly manual approach slows down responses to competitive pressure and limits the ability to grow.

Businesses in the sector need systems that can accelerate commercial workflows, integrate real-time signals, and personalize offers to customers at scale. Multi-agent AI offers a potential solution, providing a path to more flexible bidding and pricing through automated analysis and continuous adaptation.

Tags: **Sales** | **Agentic AI**

HOW AI CAN HELP

Pricing and bid preparation agents
A pricing agent analyzes input costs, market trends, competitor rates, and regulatory constraints. A bid preparation agent then drafts customized proposals based on customer histories, relevant contract terms, and compliance guidelines.

Demand forecasting and scenario modeling
A demand agent pulls in real-time signals—such as weather forecasts, energy prices, and consumption patterns—then simulates demand under different conditions to inform pricing and bid decisions.

Customer engagement coordination
An orchestration agent coordinates the bid, pricing, and demand agents to ensure cohesive action. It sequences tasks, manages version control, and forwards AI output to human commercial teams for review and execution.

Contract rollout and monitoring
After the sale, specialized agents monitor contract performance and market deviations, flagging margin erosion that needs to be addressed and triggering renewals when favorable conditions arise.

Intelligent commercial operations

MANAGING RISK AND PROMOTING TRUST

Robust and reliable	Pricing errors can reduce margins and trigger regulatory issues. Agents must be tested on historical scenarios and stress-tested for market shocks.
Fair and impartial	Agents must avoid bias toward certain customers or regions. Pricing models should be audited to ensure fairness, and human commercial teams should have the ability to override automated suggestions.
Safe and secure	Given the sensitivity of pricing data and customer value, agentic systems must include secure authentication, intrusion detection, and validation of external inputs to guard against manipulation or cyber interference.
Responsible and accountable	Escalation protocols should be in place for high-value or sensitive proposals, with humans retaining final responsibility for commercial offers and contract decisions.

POTENTIAL BENEFITS

Faster bidding cycles at lower cost

AI automation can streamline and accelerate bid preparation, reducing costs and improving responsiveness and competitiveness.

Higher margin capture

Dynamic pricing based on real-time data and scenario modeling helps maximize margins.

Scalability

AI agents help commercial teams efficiently manage larger customer portfolios, enabling faster business growth without proportional staffing increases.

Better strategic alignment

By freeing commercial teams from routine administrative tasks, AI agents allow people to focus more attention on strategic market expansion, negotiations, and relationship building.

Expediting experiments and design

Materials design

AI empowers materials designers to explore a wider design space, optimize material properties, and expedite the discovery of new materials.

ISSUE/OPPORTUNITY

Developing new materials is challenging, costly, and time-consuming. One reason is that the chemical space is vast and complex while the number of chemically feasible molecules is unknown. Also, the materials discovery, development, and optimization process present different complexities at each stage, increasing the time required to reach a final design.

Tags | R&D/Product Development

HOW AI CAN HELP

Streamline experimental process
Using AI to determine the most efficient experimental procedures for probing or optimizing materials can streamline the experimental stages of development by removing redundant experiments and undertaking those that are cost- and time-optimized.

High-entropy alloy (HEA) engineering
Traditional techniques for developing HEAs with excellent physical, chemical, and mechanical properties are time-consuming and costly, making AI modelling a promising alternative development pathway.

Expediting experiments and design

MANAGING RISK AND PROMOTING TRUST

Safe and secure

Intellectual property or a similar competitive advantage could be compromised by using AI in materials design, as models trained on proprietary or sensitive data could potentially reveal valuable insights or design strategies to competitors.

Responsible and accountable

Companies should be mindful to identify and mitigate unintended negative ramifications of materials designed with the support of AI, such as long-term environmental impacts from materials that cannot be manufactured in responsible and sustainable ways.

POTENTIAL BENEFITS

Fueling innovation

AI applications have the capability to rapidly generate and prioritize a wide range of virtual materials with diverse compositions and structures. This virtual screening process allows researchers to identify potential candidates for specific applications or material properties much more quickly than traditional experimental methods.

Bringing down costs

Through efficiency savings and the rationalization and/or elimination of experiment consumables, the organization can reduce development costs.

Enabling discovery

AI maximizes the likelihood of discovering materials with superior properties by leveraging its ability to efficiently explore and navigate a vast design space of potential materials.

Understanding the ore

Minerals processing optimization

AI can make the process of chemical separation of minerals from ore more cost- and time-efficient, safer, and more environmentally sustainable.

ISSUE/OPPORTUNITY

In mineral processing, chemical additives must be matched to the exact contents of the ore to separate as much material as possible from waste minerals without destroying it. The process is complicated due to the fact that modelling and testing each compound is time-and effort-intensive, complex mineralogy and interrelationships between minerals can hinder recovery, and environmentally hazardous chemicals are often necessary to process certain compounds.

HOW AI CAN HELP

Ore characterization and mapping
AI models can be trained on large datasets of mineral samples to generate synthetic samples that mimic the characteristics of real-world ores. Comprehensive databases can be built for mineral identification, classification, and prediction of ore properties, permitting insights into the behavior and composition of different ores without testing on known processing assays.

Process optimization
Models that simulate the physical and chemical processes involved in mineral processing can help optimize factors like grinding parameters, flotation conditions, and separation techniques. This can improve efficiency, reduce energy consumption, and enhance mineral recovery rates.

Tags: **Manufacturing & Quality**

Understanding the ore

MANAGING RISK AND PROMOTING TRUST

Robust and reliable

AI models may struggle to generalize mineral samples and processing scenarios that are significantly different from the training data. The model might not capture the full range of variations and unique characteristics of novel ores, which could lead to suboptimal processing recommendations. Also, if AI models cannot interpret complicated physical and chemical qualities like particle size distribution, mineral composition, and processing conditions, the model may generate suboptimal strategies or overlook critical factors.

POTENTIAL BENEFITS

Accelerated exploration

The cost and time needed to characterize ore and develop a processing workflow can be significantly reduced, and cost and efficiency trade-offs can be optimized to maximize mineral recovery while minimizing operational costs.

Eco-friendly operations

Keener insights into mineralogy using AI can help reduce the amount of environmentally damaging additives and resources needed for processing without sacrificing production volume or efficiency.

Occupational health

Optimized processing can help reduce human exposure to toxic chemical additives and fine particle dust, which contributes to a safer work environment.

Optimize the design

Site design generation

AI can support the development of site plans by automating aspects of the design process, providing designers with new possibilities and reducing the associated time and cost.

ISSUE/OPPORTUNITY

Site planning is a multi-stage, iterative process to optimize cost, efficiency, and safety, but it is also an expensive and time-consuming exercise involving numerous stakeholders and third-party specialists. Site planning can require surveys in remote, sometimes hostile locations. Forecasting near- and long-term impacts involves assessing a multitude of factors, and site-specific activities such as topological and geological surveying can be labor intensive and expensive.

Tags | **R&D/Product Development**

HOW AI CAN HELP

Automated layout generation
Designers can use AI to analyze site constraints, design requirements, and input from engineers to quickly generate layout options for site plans that consider factors such as zoning regulations, operational use, and user preferences.

Design optimization
AI can help optimize site plans by analyzing parameters like solar orientation, traffic flow, and accessibility to suggest optimal infrastructure placements. This can help improve energy efficiency, support better space utilization, and enhance the user experience.

Efficient documentation and annotation
By analyzing design elements and structures in the generated plans, AI can automatically annotate the plans with relevant information, such as dimensions, materials, and specifications. This automation could save designers considerable time and effort, allowing them to focus on higher level design tasks.

Optimize the design

MANAGING RISK AND PROMOTING TRUST

Responsible and accountable

AI for design optimization may focus primarily on efficiencies, such as cost reduction or time savings, while potentially neglecting other important considerations, such as environmental sustainability, community impact, or long-term adaptability. The model should be configured to balance multiple objectives and prioritize trade-offs to achieve better overall outcomes. Using AI for site planning also raises legal considerations around intellectual property, ownership of AI-generated designs, liability for design flaws, and privacy restrictions for sensitive or proprietary data.

POTENTIAL BENEFITS

Acceleration with automation

Using AI for site planning can accelerate the completion of time-consuming processes.

Discovering new solutions

With AI quickly creating a variety of site designs, the planning process can include a greater diversity of designs and promote innovative planning solutions.

Reducing risk

AI can simulate and analyze potential hazards and safety risks in site plans. AI-generated planning would consider factors such as weather events, traffic patterns, and emergency response routes. It could propose alternative design options to proactively minimize risks to safety and reduce potential property damage in case of unforeseen events.

Enhancing employee safety

Personalized OHS training

AI can be used to develop personalized and immersive occupational health and safety (OHS) training materials that allow trainees to be safely exposed to realistic scenarios and thereby reduce or better respond to real OHS incidents.

ISSUE/OPPORTUNITY

Traditional OHS training may only cover some potential scenarios, and it lacks practical opportunities to apply new skills and knowledge. Workers need to be prepared for emergency scenarios but cannot practice managing these scenarios in a real-world setting due to the cost and risk involved.

Tags | **Learning & Development**

HOW AI CAN HELP

Virtual reality (VR) training
Combined with VR, AI can be used to develop virtual training environments that replicate operational conditions. With realistic scenarios that simulate OHS incidents, trainees can navigate hazardous situations, identify risks, and improve their OHS awareness and response capabilities in a safe setting.

Customized training content
AI can be used to customize training materials based on specific job roles, site conditions, or regulatory requirements. This technology can analyze large volumes of data, such as incident reports, OHS guidelines, or compliance standards and generate tailored content, including videos, interactive modules, or quizzes.

Enhancing employee safety

MANAGING RISK AND PROMOTING TRUST

Safe and secure

Real-life emergencies can be highly stressful and traumatic, and replicating these scenarios virtually could imperil the psychological safety of trainees. The final design of simulations should be reviewed by human trainers to remove potentially harmful visualizations.

Responsible and accountable

AI-generated training materials should be continuously monitored to identify any potential issues, inaccuracies, or outdated information. Regular updates to the training content should be made to reflect the latest safety guidelines, regulations, and best practices.

Fair and impartial

AI-generated training materials should be designed to be accessible to all types of learners, including individuals with disabilities. Organizations should consider providing closed captions for videos, adjustable training scenarios to accommodate different skill levels, and alternative formats for content.

POTENTIAL BENEFITS

Safety through preparedness

Increased training engagement and readiness for emergencies supports workforce safety and fewer OHS incidents.

Customized training

A personalized approach to OHS training helps address the specific needs of workers, ensuring they receive relevant and targeted instruction.

Dynamic compliance

Changes in legislation, regulation, and policies can be quickly reflected in training materials by using AI to make updates.

Peering below the surface

Hydrocarbon reservoir exploration

AI can be used to optimize exploration success rates, reduce costs, and mitigate risks associated with hydrocarbon reservoir location and characterization.

ISSUE/OPPORTUNITY

Oil and gas exploration involves a high degree of uncertainty and risk. Advanced technologies and extensive data analysis are needed to navigate the subsurface and accurately locate and characterize reservoirs. Extracting oil and gas from underground reservoirs requires advanced drilling techniques and technologies, and harsh environmental conditions, deep water, and complex logistics make offshore exploration difficult. This makes exploration a capital-intensive and time-consuming process involving multiple stages of seismic surveys, analysis, drilling, and testing.

Tags | **R&D/Product Development**

HOW AI CAN HELP

Seismic data analysis
To overcome incomplete, low volume, or poor-quality seismic data, AI can support enhanced data analysis and interpretation. AI can be used to generate new data samples that resemble the patterns and characteristics of the existing seismic data, address missing or incomplete seismic data, improve data quality through denoising or resolution enhancement, and more effectively interpret complex data patterns.

Reservoir characterization
By analyzing data sources such as well logs, core samples, and production data, AI can create models that simulate the more complete behaviors of hydrocarbon reservoirs. This enables a better understanding of the reservoir dynamics, which helps optimize production strategies and improve recovery rates.

Peering below the surface

MANAGING RISK AND PROMOTING TRUST

Robust and reliable

False positives or misinterpretations may result in costly and time-consuming drilling operations that do not yield productive reservoirs, making human expertise crucial to validating insights and decision-making. Also, AI models could overlook critical factors or geological nuances that human geoscientists would recognize and could fail to contextualize the data when generating outputs. Without a contextual understanding, AI models and interpretations may lack accuracy or fail to capture the full complexity of reservoirs.

POTENTIAL BENEFITS

Informed investments and decisions

A deeper, more complete understanding of the characteristics of hydrocarbon reservoirs reduces uncertainty and enables better investment decisions.

Amplifying exploration

Improved data quality supports more accurate subsurface modeling, imaging, and structure characterization, which leads to an increased ability to accurately locate hydrocarbon reservoirs.

Smarter strategy

With an earlier and more complete understanding of reservoir characteristics, less time is needed to optimize production strategies.

A smart eye in the sky

Smart summaries for drone surveying

AI can assist in summarizing large volumes of drone footage and enable querying to enhance productivity and efficiency.

ISSUE/OPPORTUNITY

In the mining industry, drones are increasingly used for tasks such as mapping, management of dam tailings, safety management, blast assessment, environmental monitoring, and haul road optimization. In the case of Optical Gas Imaging (OGI) to detect gases and volatile organic compounds leaking from vessels (e.g., pipelines), unmanned drones mounted with OGI cameras have proven useful for surveying a variety of equipment over vast areas. Using drones in this way permits frequent scans and reduced costs associated with fugitive gases. Yet, while advanced AI solutions (e.g., volumetric monitoring) have been developed for applications using drone footage, manual inspection of drone footage is still required for environmental monitoring, security review, safety assessment, and retrospective analysis.

Tags **Field Services**

HOW AI CAN HELP

Smart summaries
Combined with computer vision solutions, AI can create smart assistive summaries in natural language from thousands of hours of drone footage. Assistive smart summaries can be based on a pre-determined template requested by the user, where observations are generated about elevations, topology, lighting, vegetation, and other factors. Summaries can also be queried in natural language so questions can be asked without the assessor manually reviewing all footage.

Querying the footage
When using OGI to detect leaks, there may be instances where a leak is irreparable but still must be managed. With AI, specific sites can be efficiently reviewed and monitored using simple natural language queries.

A smart eye in the sky

MANAGING RISK AND PROMOTING TRUST

Robust and reliable

AI models may struggle to interpret environmental indicators, assess ecological impacts, or consider local conditions and regulations. Training data availability and quality in particular can impact the AI model's ability to generalize and handle diverse environmental scenarios. Inadequate or biased training data may result in limited or skewed analysis and summaries.

Private

Drone footage may contain sensitive information, including personally identifiable information, facial images, or confidential business information, and the footage may also be captured on private properties or areas with restricted access. In using AI to analyze and summarize the footage, unsecure data handling and access can raise privacy concerns as well as legal and regulatory implications.

POTENTIAL BENEFITS

Supplementing human expertise

Querying smart assistive summaries helps ensure critical observations are not missed due to human error or cost and time constraints.

Faster time to insight

Replacing manual drone footage inspection with assistive summaries saves significant time and effort.

Resilient logistics and planning

Supply chain optimization

AI can support supply chain optimization by leveraging its ability to simulate, model, and generate data-driven insights.

ISSUE/OPPORTUNITY

Global supply chains are highly interconnected with many dependencies and multiple stakeholders. The inherent complexity creates challenges to efficiency, resilience, and cost avoidance, making supply chain intelligence a critical component of supply chain management. What is needed is a way to rapidly analyze data from internal and external sources to identify patterns and areas for improvement.

Tags | **Procurement/Sourcing & Supply Chain**

HOW AI CAN HELP

Supply chain intelligence
AI can help identify and simulate potential disruptions or risks in the supply chain. By assessing port congestion, shipment routes, and tier-n supplier mapping, AI can be used to predict risks and their corresponding impact on operations, then recommend actions to mitigate those risks. This allows supply chain managers to proactively implement mitigation strategies, develop contingency plans, and improve overall resilience.

Scenario analysis and optimization
Supply chain managers can use AI to run what-if scenarios in a digital twin environment that reflects the real-world supply chain. By simulating the impact of changes in demand patterns, production capacity, inventory strategies or supplier reliability, supply chain managers can improve risk assessments and proactive decision-making based on real-time conditions.

Supply chain planning
AI enables supply chain professionals to use natural language to interact with advanced planning solutions. Questions concerning all supply chain areas, such as planning, inventory, supply assurance, order management, and global logistics, can be easily asked, helping even less experienced users navigate complex topics and data.

Supplier assessment
AI can assist in supplier evaluation and relationship management by analyzing financial reports, performance metrics, customer feedback, and other data and then generate insights and predictions around supplier performance, risk factors, and opportunities for collaboration. This helps supply chain professionals make informed decisions when selecting, negotiating with, and managing suppliers.

Resilient logistics and planning

MANAGING RISK AND PROMOTING TRUST

Robust and reliable

Supply chain management involves complex trade-offs, strategic considerations, and tacit knowledge that AI models may not fully capture. AI outputs may also fail to balance ethical considerations or long-term strategic goals. As such, human judgment and validation is central to the interpretation and augmentation of AI outputs.

Fair and impartial

When using AI for supplier evaluation, negotiating, and contracting, bias in the data or model could lead to unfair recommendations and discriminatory practices. By taking into account factors such as fair contract terms, social responsibility, and ethical sourcing practices, organizations can promote decision-making processes that are fair and transparent.

POTENTIAL BENEFITS

Resilient supply chains

Enhancing supply chain resilience allows the organization to respond quickly to changing market dynamics and permits greater agility to take advantage of emerging opportunities based on real-time insights and recommendations.

Enhanced performance

By prioritizing alerts that require human intervention and differentiating between noise and disruption, the organization can drive greater efficiency in the supply chain.

Optimizing efficiency

Making optimized decisions across the supply chain, from supplier selection to fulfilment optimization, helps reduce costs, minimize waste, and improve overall operational efficiency.

Enabling a better grid

Grid and energy efficiency optimization

AI can be used to better understand the state of the grid and factors that could support more efficient energy consumption, minimizing losses and improving overall grid efficiency.

ISSUE/OPPORTUNITY

Energy grids are massive and intricate systems with interconnected components operating in a dynamic and uncertain environment. Maintaining a balance between energy supply and demand is crucial for grid stability, but it is challenged by the difficulty in predicting and managing fluctuations in energy demand. The integration of intermittent renewable energy sources (e.g., solar) further complicates the supply-demand balancing act as these depend on weather conditions. Regulatory frameworks, policies, and market structures also constrain the ability to balance technical optimization.

Tags: **Operations**

HOW AI CAN HELP

Promote informed customer behavior
Energy companies can incentivize consumers to adjust their energy consumption based on their specific energy use patterns using conversational chatbots powered by generative AI. AI models can analyze historical data and customer preferences to recommend personalized strategies to reduce energy usage. When there is an immediate need to reduce peak loads to improve grid stability, AI applications can be used to alert customers about what they can specifically do to help. What is more, conversational chatbots can be used as an educational tool for consumers to understand and optimize their energy usage.

Document and map digitization
AI can be used to digitize documentation, infrastructure maps, and records of energy use, as well as for image-to-image translation or image restoration (e.g., by removing noise, adjusting brightness, and enhancing contrast). This improves the quality of the documents and yields searchable documents that can be used to train existing AI classification and forecasting tools.

Grid layout and expansion
AI can assist in designing optimal configuration and expansion plans for the energy grid. AI models can generate optimized grid designs that minimize transmission losses and maximize efficiency by considering factors such as population density, existing infrastructure, and energy demand projections.

Energy trading and market analysis
AI models can simulate the behavior of electricity markets under different scenarios, such as regulation changes or the introduction of new technologies. This can help energy companies optimize their trading strategies and make more informed investment decisions.

Enabling a better grid

MANAGING RISK AND PROMOTING TRUST

Private

Using AI in customer behavior analysis and chatbot interaction involves handling sensitive customer data. Risks include data breaches and unauthorized access to customer information and chat logs, and risk mitigation requires robust security measures, customer data protection, and adherence to privacy regulations.

Safe and secure

AI models are vulnerable to adversarial attacks, where malicious actors manipulate inputs to deceive or exploit the system, for example, to influence energy trading decisions or disrupt grid operations. Robust security measures and regular testing are necessary to mitigate such risks.

POTENTIAL BENEFITS

Diversifying energy sources

AI supports the integration of variable renewable energy sources while maintaining stability and reliability.

Dynamic demand response

Using AI for improved visibility of the grid's current state allows companies to better respond to fluctuations in demand.

Ongoing optimization

As more trends, data and documents are digitized and analyzed over time, AI enables continuous improvement in efficiency optimization and managing demand.

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