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The Energy, Resources & Industrials Generative AI Dossier

A selection of high-impact use cases

By 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.

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Introduction

The advent of Generative AI has delighted and surprised the world, throwing open the door to AI capabilities once thought to be still far off in our future. With a remarkable capacity to consume and generate novel outputs, Generative AI is prompting excitement and stimulating ideas around how this type of AI can be used for organizational benefit. Far more than a sophisticated chatbot, Generative AI has the potential to unleash innovation, permit new ways of working, amplify other AI systems and technologies, and transform enterprises across every industry.

This compendium highlights 60 of the most compelling use cases for Generative AI across six major industries:

- **Consumer** (which includes Consumer Products, Retail, Automotive, Lodging, Restaurants, Travel, and Transportation)

- **Energy, Resources, and Industrial** (ER&I)

- **Financial Services** (FSI)

- **Government & Public Services** (GPS)

- **Life Sciences & Health Care** (LSHC)

- **Technology, Media, and Telecommunications** (TMT)

For each of these industries, we explore Generative AI use cases that can address enterprise challenges in new ways, permit more and greater capabilities across business functions, and deliver advantages in efficiency, speed, scale, and capacity.

As with any type of AI, there are potential risks. We use Deloitte's Trustworthy AI™ framework to elucidate factors that contribute to trust and ethics in Generative AI deployments, as well as some of the steps that can promote governance and risk mitigation. Trustworthy AI in this respect is: fair and impartial, robust and reliable, transparent and explainable, safe and secure, accountable and responsible, and respectful of privacy.

To be sure, this collection of use cases is just a sample among myriad other applications, some of them yet to be conceived. As Generative AI matures as a technology and organizations move forward with using it for business benefit, we will likely see even more impressive and compelling use cases. The applications highlighted here can help spark ideas, reveal value-driving deployments, and set organizations on a road to making the most valuable use of this powerful new technology.

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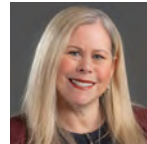
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Six key modalities

One of the primary differences between more traditional AI and Generative AI is that the latter can create novel output that appears to be generated by humans. The coherent writing and hyper-realistic images that have captured public and business interest are examples of Generative AI models outputting data in ways once only possible with human thought, creativity, and effort. Today, Generative AI models can create outputs in six key modalities.

Text
Written language outputs presented in an accessible tone and quality, with details and complexity aligned with the user's needs.

Examples include summarizing documents, writing customer-facing materials, and explaining complex topics in natural language.

Code
Computer code in a variety of programming languages with the capacity to autonomously summarize, document, and annotate the code for human developers.

Examples include generating code from natural language descriptions and autonomously maintaining code across different platforms.

Audio
Much like textual outputs, audio outputted in natural, conversational, and even colloquial styles with the capacity to rapidly shift among languages, tone, and degrees of complexity.

Examples include Generative AI-powered call centers and troubleshooting support for technicians in the field.

Image
Textual or visual prompts lead the model to create images with varying degrees of realism, variability, and "creativity."

Examples include simulating how a product might look in a customer's home and reconstructing an accident scene to assess insurance claims and liability.

Video
Similar to imagery, Generative AI models can take user prompts and output videos, with scenes, people, and objects that are entirely fictitious and created by the model.

Examples include autonomously generating marketing videos to showcase a new product and simulating dangerous scenarios for safety training.
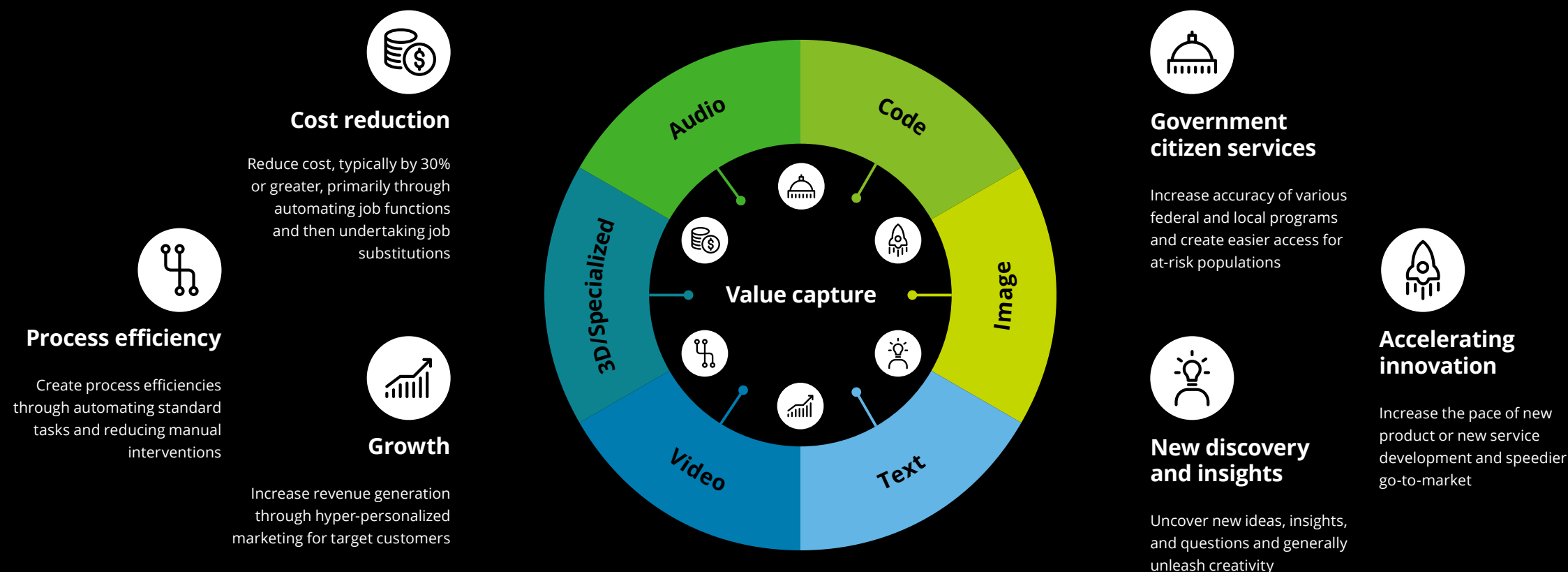
3D/Specialized
From text or two-dimensional inputs (e.g., images), models can extrapolate and generate data representing 3D objects.

Examples include creating virtual renderings in an omniverse environment and AI-assisted prototyping and design in a purely virtual space.

By understanding these modalities, organizations are empowered to think through and better understand the kinds of benefits Generative AI could permit. For each use case described in this dossier, there may be more than one value-driving modality. A chatbot text output could be presented as simulated audio; a generated image could be extended into a video. Ultimately, the Generative AI use case and the value the organization seeks will determine which output modalities can contribute the greatest advantages and outcomes.

Broad categories of value capture from Generative AI

The value that Generative AI use cases can enable can be conceived across six dimensions: cost reduction, process efficiency, growth, innovation, discovery and insights, and government citizen services. To be sure, a single use case can drive more than one value capture, but to help paint the vision for how Generative AI can be used to move the needle on competitive differentiators and operational excellence, the use cases described in this dossier are each associated with a primary value capture.

Cost reduction

Reduce cost, typically by 30% or greater, primarily through automating job functions and then undertaking job substitutions

Process efficiency

Create process efficiencies through automating standard tasks and reducing manual interventions

Growth

Increase revenue generation through hyper-personalized marketing for target customers

Government citizen services

Increase accuracy of various federal and local programs and create easier access for at-risk populations

New discovery and insights

Uncover new ideas, insights, and questions and generally unleash creativity

Accelerating innovation

Increase the pace of new product or new service development and speedier go-to-market

Value capture

Audio

Code

Image

Text

Video

3D/Specialized

Companies in the Energy, Resources, & Industrials (ER&I) industry face challenges related to energy security, affordability, profitability, and the transition towards a cleaner and sustainable future. Adopting Generative AI presents an attractive opportunity to help address these critical areas. Integrating Generative AI across the industry can lead to cost avoidance, operational efficiencies and resilience, and reduced emissions.

Historically, the ER&I industry has tended to take a conservative approach in embracing novel technologies, owing to the investment required to access new benefits while mitigating new risks. Consequently, companies may be hesitant to become early adopters of Generative AI. Yet, incumbent firms (particularly in construction, mining, and energy production) may hold an inherent advantage in this domain, as they possess exclusive and proprietary data that can be used to finely calibrate Generative AI models for specific requirements and value-driving use cases. This grants them the potential to take a leading market position when leveraging Generative AI models.

There is increasing pressure on companies in this industry to transition to more sustainable and environmentally friendly practices. This pressure is exacerbated by the global shift towards renewables and the need to diversify the energy mix. Generative AI may hold transformative potential in this regard. For example, Generative AI is revolutionizing resource exploration and extraction processes. Resource-rich areas can be quickly identified by capitalizing on vast amounts of geological and geophysical data. As an example, Generative AI could be employed by Oil and Gas companies to overcome the complex logistical challenges of offshore exploration. Synthetic seismic data generation and generative modelling of hydrocarbon reservoirs can optimize

There is increasing pressure on companies in this industry to transition to more sustainable and environmentally friendly practices.

exploration efforts and increase resource extraction efficiency while limiting disturbance to the surrounding environment. By optimizing energy usage, minimizing waste, and supporting the development of eco-friendly technologies, by automating certain parts of the design process, Generative AI can contribute to a more sustainable and responsible approach to resource extraction and industrial operations.

Initiating the adoption of Generative AI at this juncture goes beyond merely gaining a competitive edge in the present. It also entails establishing a foundation for future growth by investing in the workforce. Contemplating the ER&I industry's future, Generative AI will likely assume a central role in optimizing and mitigating health and safety risks by generating worksite-specific safety training that replicates real-world settings and critical scenarios. As companies transition to the environmentally sustainable business model, Generative AI could develop real-time, bespoke training materials that support workforce transition and adoption of sustainable practices.

By embarking on the exploration and implementation of Generative AI now, companies can acquire valuable insights, adapt to its nuances, and evolve alongside the advancing technology. This strategic approach will position organizations to leverage the full capabilities of Generative AI as it reaches maturity.

As companies transition to the environmentally sustainable business model, Generative AI could develop real-time, bespoke training materials that support workforce transition and adoption of sustainable practices.

Keeping the equipment healthy
(Asset Maintenance Planning)

Generative AI in asset maintenance planning can improve equipment uptime, reduce maintenance costs, and enhance operational efficiency.

Issue/opportunity

In mining and oil and gas operations, maintenance planning helps prevent premature equipment failure, costly repairs and replacements, and extends the life of an asset. Facing near- and long-term constraints and factors, maintenance plans and the subsequent downstream processes can be changed to align with production, in response to resource availability, or because of unexpected events. Making maintenance plan alterations, however, can be costly and labor intensive.

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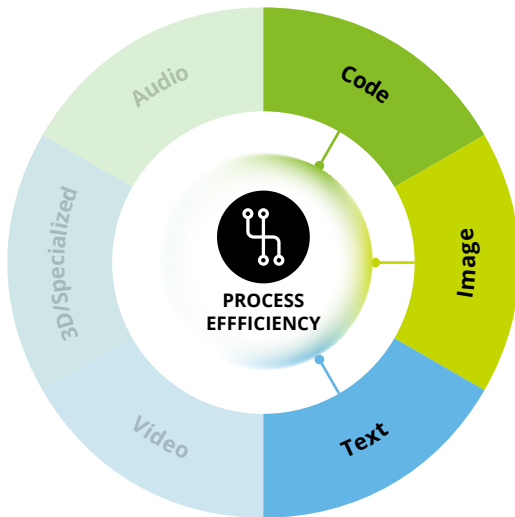
How Generative AI can help

Continuous improvement
Generative AI can be used to reconcile lessons learned from prior shutdowns, identify opportunities for maintenance alignment, provide planners with the information needed to challenge assumptions on maintenance alignment, and develop strategies to minimize the impact across the system.

Optimal maintenance scheduling
Generative AI helps optimize maintenance schedules by weighing operational factors (e.g., equipment use, production requirements, and maintenance costs), recommending the most efficient and cost-effective schedules, and analyzing equipment use and performance data to minimize downtime and maximize equipment availability.

Simulation and optimization
Generative AI can simulate maintenance scenarios and evaluate the impact of maintenance strategies on equipment performance, productivity, and operational efficiency. This helps reveal the most effective maintenance approaches and optimizes resource allocation for maintenance activities.

Keeping the equipment healthy

Managing risk and promoting trust

Robust and reliable

Generative AI applications for asset maintenance planning depend on the quality of the data. Data that is incorrect, incomplete, or is not representative of the current operational environment or maintenance practices can lead to a suboptimal and potentially inappropriate maintenance plans that may even be detrimental to asset health management and future maintenance planning activities.

Accountable

There is no machine substitute for a human asset maintenance planners' knowledge, experience, and expertise. Overreliance on AI-generated outputs without critical human review may lead to important contextual factors and valuable insights being overlooked.

Safe and secure

Generative AI models may struggle to account for the uncertainties inherent in asset maintenance planning, like unexpected equipment failures or changing production requirements. Suboptimal or unrealistic Generative AI recommendations due to overfitting can lead to inaccuracies or poor performance when applied to real-world maintenance scenarios. The degree of human intervention and oversight needed must be considered in the design phase of the solution. This is especially true in intricate operational constraints which may prevent Generative AI from providing accurate and feasible solutions.

Potential benefits

Proactive cost improvements
Maintenance plans can be dynamically altered at different time scales in response to changes in upstream plans, which not only helps minimize the impact of down time but also maximize the use of available resources for asset maintenance.

Increased volume delivery
Improved alignment of planned maintenance and production helps increase volume without compromising asset management strategies.

Greater health and safety
Optimal resource allocation, accommodation management, and shutdown duration all support occupational health and safety outcomes.

Expediting experiments and design

(Materials Design)

Generative 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, and one reason is that the chemical space is vast and complex while the number of chemically feasible molecules is unknown. What is more, the materials discovery, development, and optimization process attracts different complexities at each stage, increasing the time required to reach a final design.
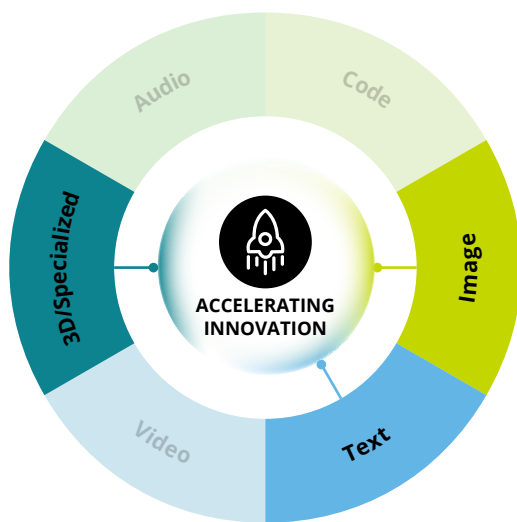
How Generative AI can help

Streamline experimental process
Using Generative 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 generative modelling a promising alternative development pathway.

Audio · Code · Image · Text · Video · 3D/Specialized · ACCELERATING INNOVATION

Expediting experiments and design

Managing risk and promoting trust

Security

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

Responsible

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

Potential benefits

Fueling innovation
Generative 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
Generative 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)

Generative 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 as possible from waste minerals without destroying them. The process is complicated due to the facts 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.
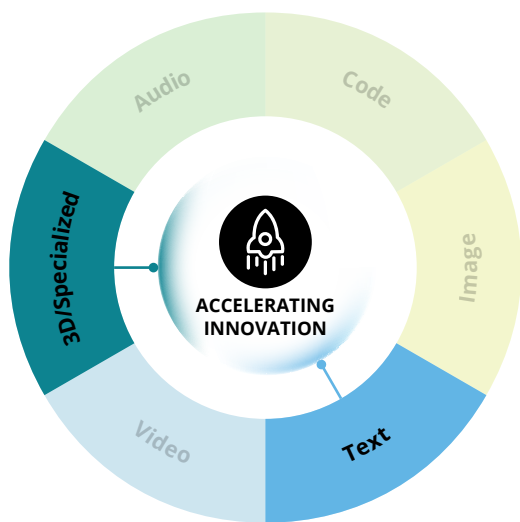
How Generative AI can help

Ore characterization and mapping
Generative 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.

ACCELERATING INNOVATION

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Understanding the ore

Managing risk and promoting trust

Robust
Generative 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.

Reliable
If Generative AI models cannot interpret complicated physical and chemical qualities like particle size distribution, mineral composition, and processing conditions (typically as they are not explicit in the data), 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 Generative 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.
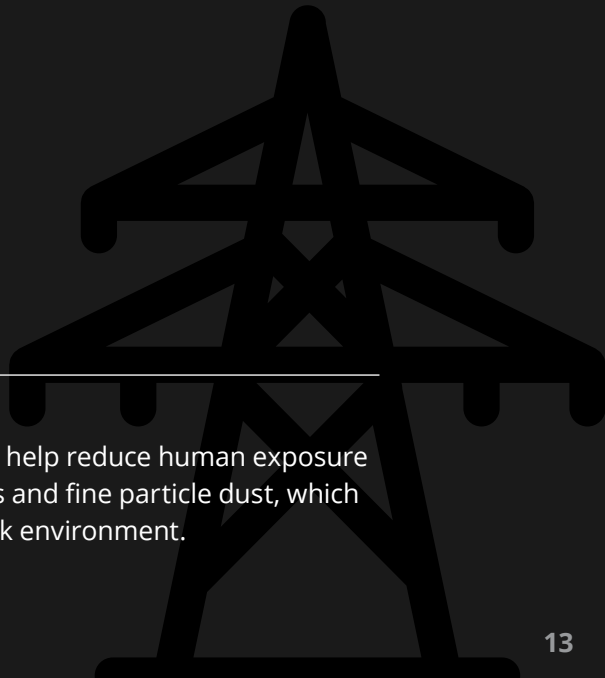
Optimize the design
(Site Design Generation)

Generative 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.
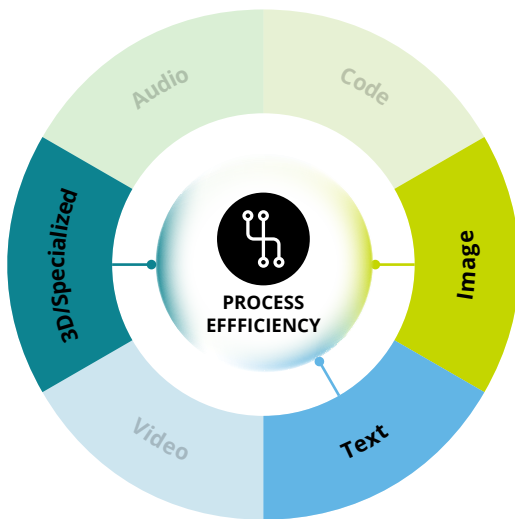
How Generative AI can help

Automated layout generation
Designers can use Generative 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
Generative 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, Generative 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

Generative 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.

Accountable

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

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

Reducing risk
Generative 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 damages in case of unforeseen events.

A helping hand in the field
(Virtual Field Assistant for Engineers)

A Generative AI-enabled virtual field assistant can provide engineers with on-demand access to engineering knowledge and support in problem solving, improving efficiency, productivity, and decision-making capabilities.

Issue/opportunity
Engineers sometimes work in remote or challenging environments, and they regularly experience information challenges, such as a lack of manuals or the need to localize the source of a problem. Because of this, engineers may need to seek further guidance and return to the site at a later time.
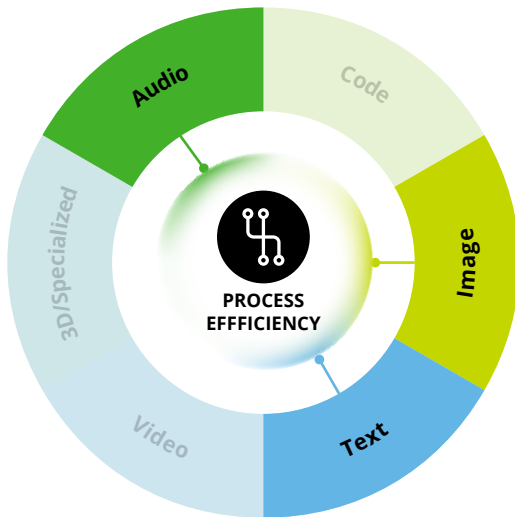
How Generative AI can help

Easily accessible technical information
A Generative-AI enabled virtual field assistant can serve as a reference tool and provide quick access to a vast amount of technical information. As well as delivering relevant information and directing engineers to appropriate resources, a virtual field assistant can help with problem solving by responding to questions about specific engineering concepts, principles, or calculations.

Troubleshooting and diagnostics
When encountering issues or challenges in the field, engineers can describe the problem to a virtual field assistant, and it will return appropriate questions to identify the cause or provide step-by-step guidance for resolution.

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A helping hand in the field

Managing risk and promoting trust

Robust and reliable

A virtual assistant's accuracy depends on the quality of its training data, and if the data is inaccurate or outdated, its incorrect outputs could lead to potential harms to the engineer, damage to equipment, or operational downtime. In addition, Generative AI's potential to hallucinate outputs means the virtual assistant may make recommendations that are erroneous or contextually inappropriate. The potential for misinterpretation or misinformation underscores the importance of engineers cross-verifying information, especially regarding safety-critical processes or decisions.

Responsible

With a typically reliable virtual assistant, engineers may become overly dependent on the assistant and fail to balance its output with their own skills and judgement. In complex situations requiring creative problem solving or critical thinking, relying solely on the assistant's responses may be insufficient.

Accountable

If incorrect information or advice from the virtual field assistant leads to an accident or operational failure, there may be complex liability issues to resolve. Clear guidelines and procedures for addressing these situations should be established as a part of model governance.

Potential benefits

Cost savings

By giving engineers an information and troubleshooting resource, the organization can improve the efficiency of its operations, with corresponding value for cost savings.

Improved effectiveness in the field

Informed problem solving and decision-making supports task completion with minimal remediation.

Occupational health

By more rapidly addressing issues with the aid of a virtual assistant, engineers may spend less time in the field exposed to potential environmental hazards.
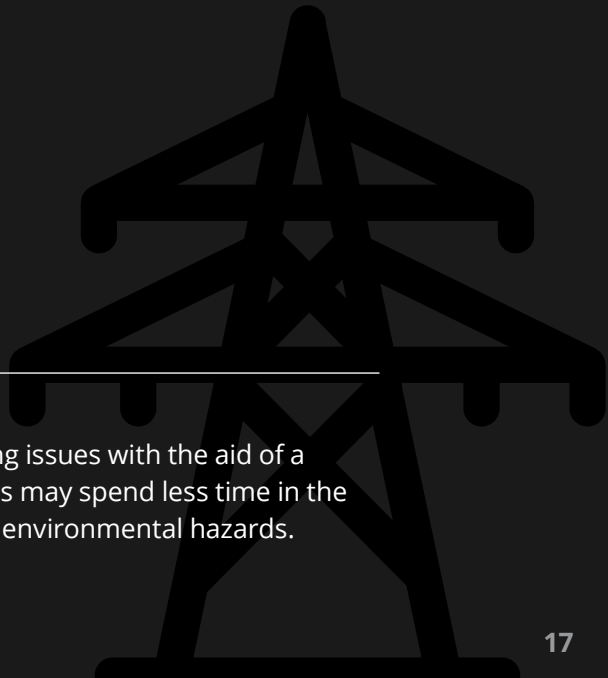
Enhancing employee safety
(Personalized OHS Training)

Generative 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.
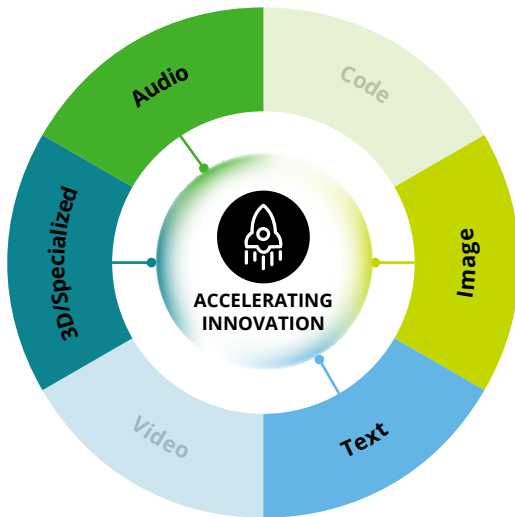
How Generative AI can help

Virtual reality (VR) training
Combined with VR, Generative 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
Generative 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. Replicating these scenarios virtually could imperil the psychological safety of trainees, and the final design of simulations should be reviewed by human trainers to remove potentially harmful visualizations.

Responsible and accountable
The 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
The AI-generated training materials should be designed to be inclusive and accessible to all types of learners, including individuals with disabilities. Considerations such as providing closed captions for videos, adjustable training scenarios to accommodate different skill levels, and alternative formats for content taken into account.

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 Generative AI to make updates.
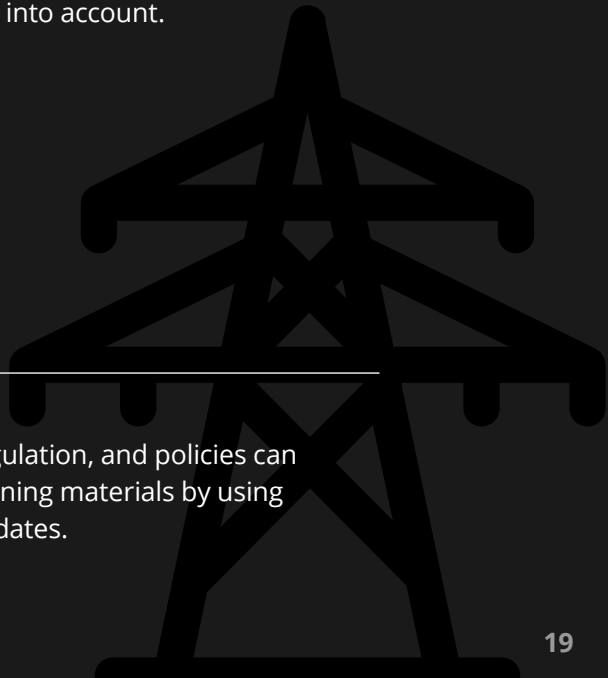
Peering below the surface

(Hydrocarbon Reservoir Exploration)

Generative 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. As result, exploration is a capital-intensive and time-consuming process involving multiple stages of seismic surveys, analysis, drilling, and testing.
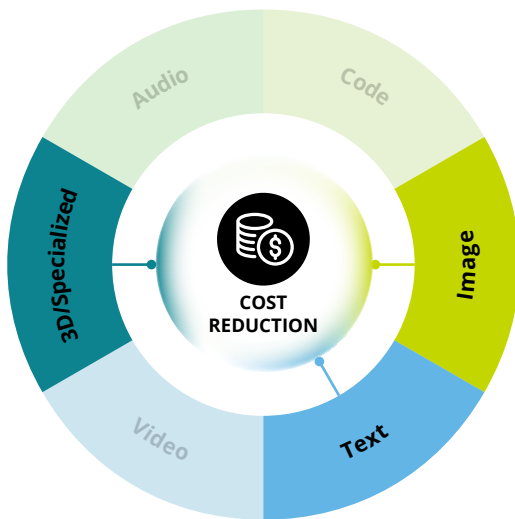
How Generative AI can help

Seismic data analysis
To overcome incomplete, low volume, or poor-quality seismic data, Generative AI can support enhanced data analysis and interpretation. Generative AI could be used to generate new data samples that resemble the patterns and characteristics of the existing seismic data, addresses 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, Generative 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

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.

Robust
Generative AI models may fail to consider critical factors or geological nuances that human geoscientists would recognize and so the model fails to contextualize the data when generating outputs. Without contextual understanding, the AI-generated 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 the degree of uncertainty and supports investment decisions.

Amplifying exploration
Improved data quality supports more accurate subsurface modeling, imaging, and structure characterization, which translates 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.
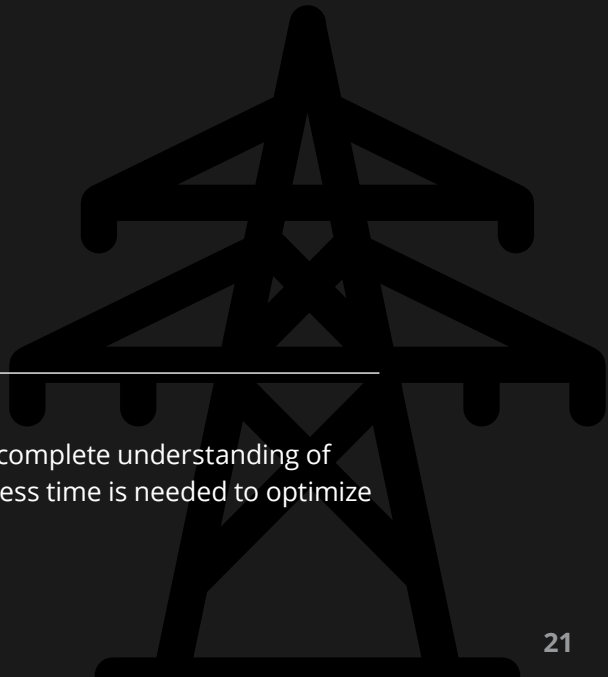
A smart eye in the sky

(Smart Summaries for Drone Surveying)

Generative 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, tailings dam management, safety management, blast assessment, environmental monitoring, and haul road optimization. In the case of Optical Gas Imaging (OGI) to detect gasses 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.
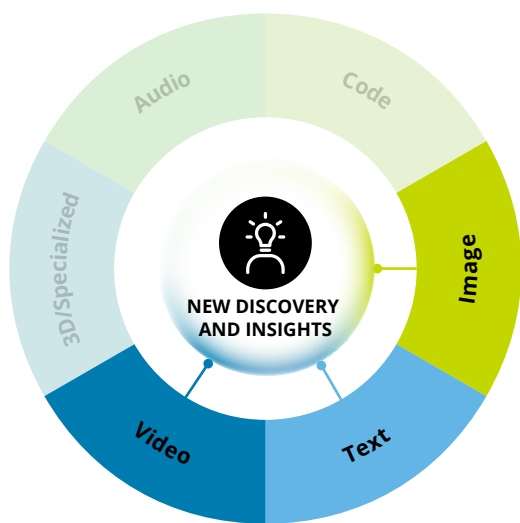
How Generative AI can help

Smart summaries
Combined with computer vision solutions, Generative 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 Generative AI, specific sites can be efficiently reviewed and monitored by querying the footage of that site using natural language.

A smart eye in the sky

Managing risk and promoting trust

Reliable
Generative 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.

Privacy
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 Generative 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 keep 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)

Generative 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 challenges 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.
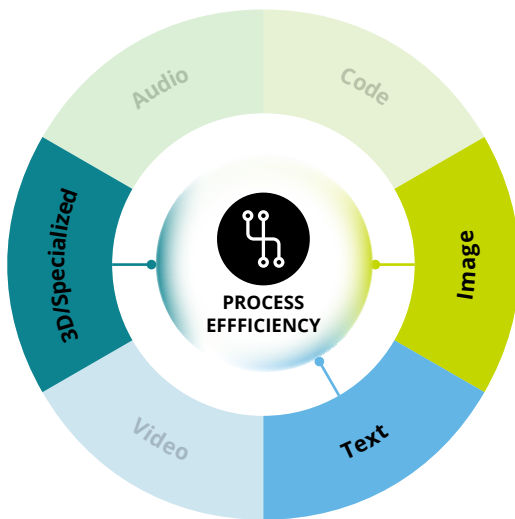
How Generative AI can help

Supply chain intelligence
Generative AI could help identify and simulate potential disruptions or risks in the supply chain. By assessing port congestions, shipment routes, and tier-n supplier mapping, Generative AI can be used to predict risks, their corresponding impact on operations, and 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 could use Generative 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
Generative 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
Generative 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

Reliable
Supply chain management involves complex trade-offs, strategic considerations, and tacit knowledge that the AI models may not fully capture. Generative 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 Generative AI outputs.

Fair and impartial
When using Generative 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 prioritising 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.
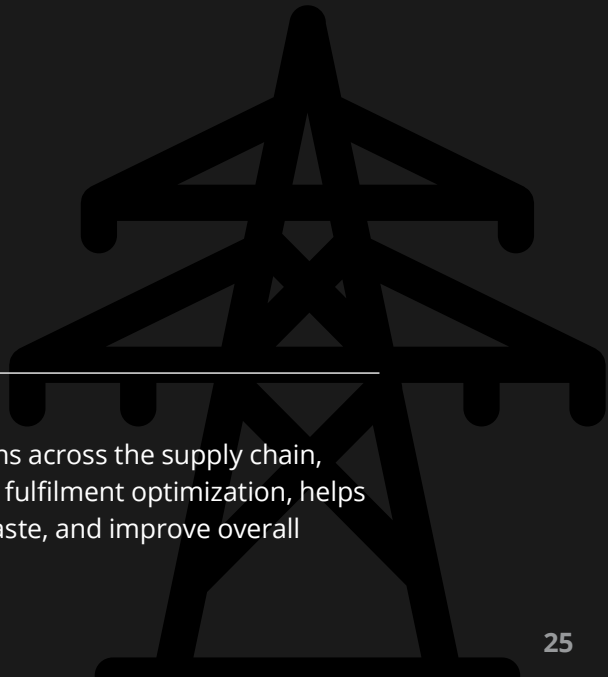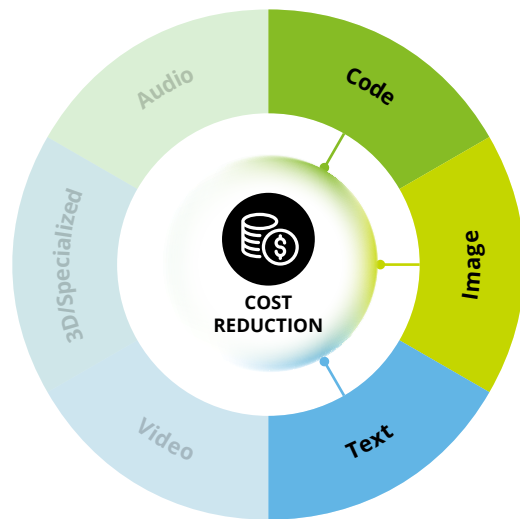
Enabling a better grid
(Grid and Energy Efficiency Optimization)

Generative 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.

COST REDUCTION

Audio · Code · Image · Text · Video · 3D/Specialized

How Generative AI can help

Aid conscious 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, Generative AI applications can be used to alert customers as to what they can do specifically 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
Generative AI can be used to digitize documentation, infrastructure maps, records of energy use, as well as for image-to-image translation or image restoration (such as 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
Generative AI can assist in designing the 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
Generative 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

Privacy
Using Generative 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.

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

Dynamic demand response
Using Generative 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, Generative AI enables continuous improvement in efficiency optimization and managing demand.
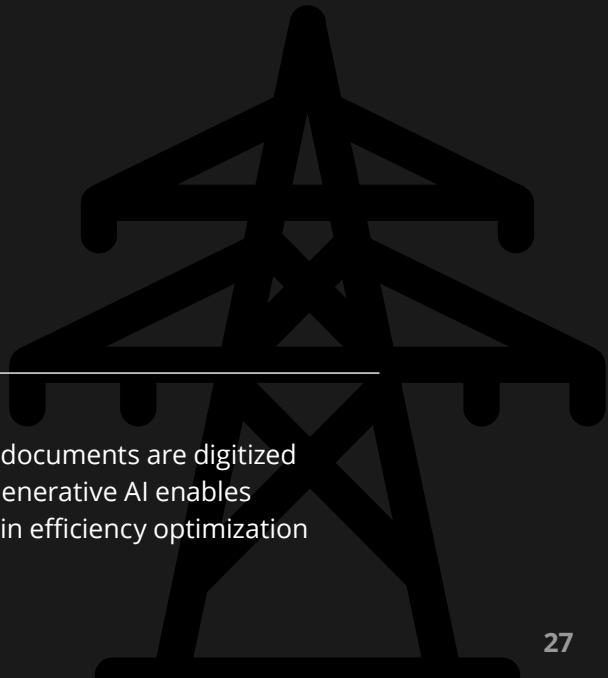
Predictive maintenance in Oil & Gas

(Layering GenAI on top of existing AI-powered systems to improve predictive maintenance)

Oil and gas companies are using GenAI to transform complex sensor data into targeted, actionable insights, reducing unplanned downtime and operational risk.
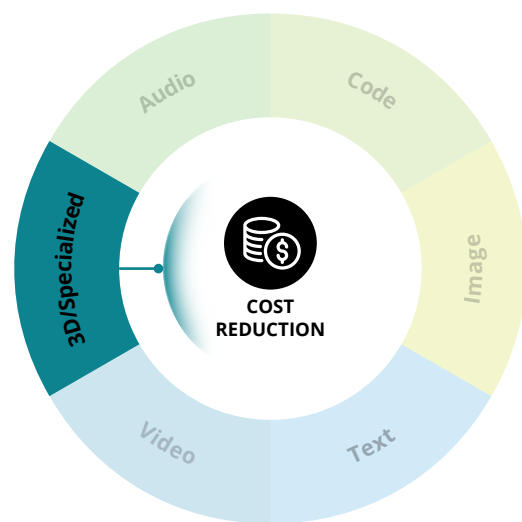
Issue/opportunity

Oil and gas production facilities—whether offshore platforms, drilling rigs, or onshore plants—are highly complex environments with thousands of critical equipment components. Unexpected failures in pumps, compressors, valves, or separation systems can bring production to a halt, triggering safety risks and revenue losses that quickly escalate.

Traditional predictive maintenance systems use high-volume sensor and maintenance log data to forecast potential failures using probabilistic models, categorizing equipment status as red, amber, or green depending on predicted failure risk and timing. But engineers often struggle to determine which alerts are genuinely urgent, and what actions should be taken.

How Generative AI can help

Monitoring sensors and flagging potential failures
Many companies in the industry already rely on traditional AI models to monitor sensor data and identify potential failures. However, these systems often produce an overwhelming number of alerts, many of which are false positives or lack actionable context, placing a heavy burden on engineering teams and delaying response times.

Turning data into action
GenAI can solve the human interface challenge by providing a natural language layer on top of existing predictive models. Pulling from structured AI outputs, historical feedback data, and document repositories (such as manuals, repair logs, and technical bulletins), GenAI can provide targeted, explainable responses and help prioritize response actions. It can also flag questionable predictions based on past false positives—and even suggests next steps—all in an intuitive, easy-to-consume format.

Predictive maintenance in Oil & Gas

Managing risk and promoting trust

Responsible and accountable

Given the safety-critical nature of oil and gas operations, deploying AI systems—especially those involving infrastructure or decision support—requires strong governance and alignment with regulatory expectations. A centralized governance board or cross-functional AI oversight team should ensure that every new GenAI use case is subjected to a rigorous value/risk assessment, and that accountability is maintained at the site or business unit level for all decisions.

Robust and reliable

AI-powered predictive maintenance systems continuously learn from actual maintenance outcomes. Each time a flagged issue turns out to be a false alarm—or conversely, when a missed alert leads to failure—the outcome should be fed back into both the traditional AI and GenAI layers to improve future performance.

Transparent and explainable

Engineers can see not just what the system recommends, but why. Historical trends, reliability data, and source documents should be cited to support the system's recommendations and prioritization, making the results easier to trust and audit.

Potential benefits

Less unplanned downtime
By improving how engineers interpret and act on AI-generated alerts, oil and gas companies can reduce production disruptions.

Lower operating costs
Smarter maintenance planning can reduce emergency repairs, overtime labor, and expedited parts logistics, all of which can be expensive.

Improved engineering productivity
Field teams can spend less time triaging alerts and more time addressing high-priority issues, leading to measurable productivity improvements. Also, junior engineers and less-experienced technicians can be better equipped to understand and respond to maintenance issues with GenAI's contextual guidance.

Faster scaling and adoption
Integrating GenAI into existing predictive maintenance platforms can reduce the operational overhead of adopting new tools or training programs.

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Conclusion

Getting the most value from Generative AI

These are the early days of Generative AI, but the technology is rapidly maturing. As it does, organizations in every industry will probe how this type of AI can contribute to their business and open doors to transformative opportunities. As such, an important part of understanding and working with Generative AI is shaping the vision for the future, acknowledging both the potential benefits and the risks.

In this Generative AI-enabled era, governance and risk mitigation are business imperatives. The challenges organizations face with traditional AI are amplified in this new arena. A commitment to the trustworthy development and use of Generative AI will only become more important as the capabilities grow and governing bodies shape rules for their application.

Still, there is also a risk in waiting to embrace Generative AI. The use cases described in this dossier are a starting point for exploring how this powerful technology can be used to improve the enterprise today and prepare it to lead in the future.

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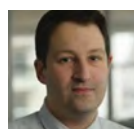
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