NTT DATA

Energy & Utilities

Digital solutions for the new energy era



Introduction

In a complex and volatile world, energy companies have to balance the often conflicting demands of profitability, energy security, and decarbonization. They have found an ally in GenAI and other advanced technologies that are helping players gain greater insight and execute more effectively, so enabling them to become to more agile, resilient and, ultimately, more successful.

Geopolitical events such as the Russia-Ukraine conflict have vividly demonstrated the growing importance of energy security at a time when the greater penetration of intermittent energy sources creates more volatility and additional challenges to the power grid.

While firms continue developing renewable energy projects, new investments are being approached cautiously, focusing on commercial viability and clear value propositions.

With oil production in gradual decline, liquefied natural gas (LNG) is now gaining prominence as a transitional fuel because of its lower CO_2 emissions and proven role in providing energy security.

Structural adjustments are also reshaping the energy industry. Companies are streamlining operations by separating power generation from trading functions, for example.

These trends highlight the dynamic tension between energy transition goals and the immediate realities of market pressures and energy security.

GenAI and other advanced technologies can help companies better address these conflicting demands and drive innovation in energy companies. From optimizing supply chains to leveraging advanced analytics for operational efficiency, GenAI will also help support the sector's dual objectives of profitability and sustainability.

Below we explore the many ways that we can help energy companies innovate and improve operations up and down the value chain, so setting the foundations for a more efficient and sustainable sector in Europe.

Exploration and production

Exploration and production (E&P) is central to ensuring a steady supply of oil and gas resources. However, the E&P industry faces significant challenges, including fluctuating oil prices, increasing regulatory pressures, and growing environmental concerns.

Resource depletion in mature fields and the push for net-zero emissions demand innovative approaches to sustain operations and avoid stranded assets.

AI transforms upstream

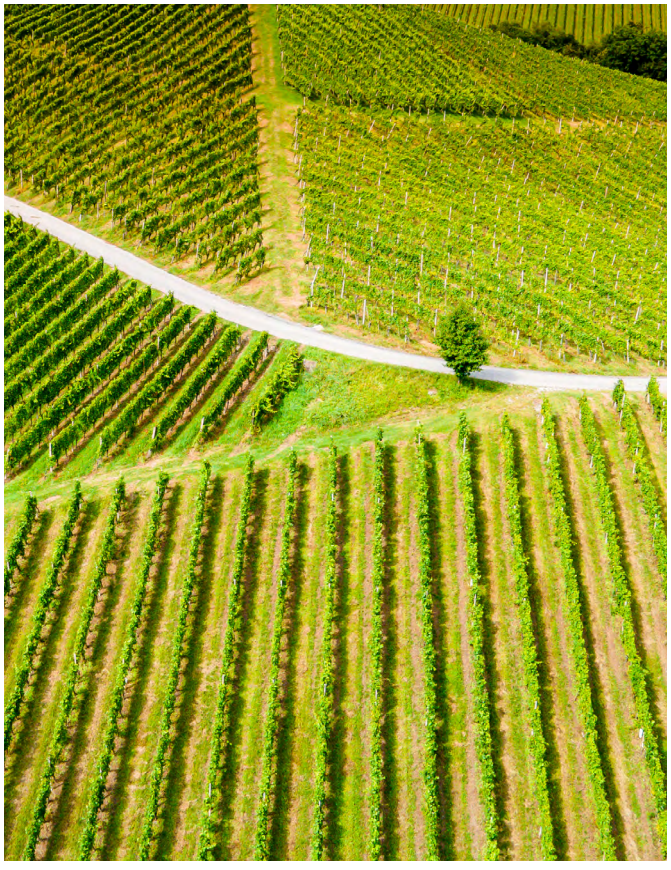
AI is rapidly transforming upstream operations by enhancing precision and efficiency. For instance, predictive maintenance powered by AI analyzes data from sensors installed on drilling rigs and other critical equipment to foresee failures before they occur, significantly reducing downtime. AI algorithms also refine reservoir modeling by analyzing seismic data and production history, enabling more accurate predictions about reservoir potential and optimizing extraction strategies.

AI can enhance drilling operations by integrating real-time data on geological formations, equipment performance, and environmental conditions. These insights enable operators to make better-informed decisions, such as adjusting drill paths to maximize yield or minimize environmental risks. The adoption of AI represents a step forward in tackling the dual challenges of efficiency and sustainability in upstream operations.

> “With energy transition goals reshaping industry priorities, the upstream sector is focusing on more efficient and sustainable ways to meet global energy demands.”

Chemicals, refining and biofuels

The downstream sector encompasses refining, chemical production, and biofuels, serving as a critical bridge between raw material extraction and end-use energy products. However, its processes are capital-intensive and face mounting pressures to decarbonize and improve efficiency amid volatile markets and regulatory scrutiny.



The downstream sector seeks to avoid disruptions in supply chains and adapt to shifts in demand, such as the rise in electric vehicles reducing gasoline consumption. To remain competitive, downstream operators are investing in digital transformation and innovative technologies that optimize operations and enhance sustainability.

Enhancing downstream with GenAI

GenAI provides significant opportunities to improve efficiency and sustainability in downstream operations, by optimizing the design of refineries, for example, or by analyzing data from control systems to identify inefficiencies, optimize energy usage, and predict maintenance needs.

In biofuels production, AI models can enhance feedstock conversion processes, improving yields while minimizing waste. Additionally, AI enhances decision-making in control rooms by integrating large datasets into actionable insights, enabling operators to respond quickly to fluctuations in market demand or supply chain disruptions. These advancements help downstream companies improve profitability while advancing their sustainability objectives.

Power generation

With decarbonization targets reshaping market dynamics, generating companies are leveraging technology to optimize traditional power generation while accelerating the adoption of renewables. Comprehensive asset management is vital to ensuring efficiency across all stages of power generation, from the design and construction of facilities to their operation and eventual decommissioning.

Advanced digital tools enable real-time monitoring and predictive maintenance, extending the life of critical infrastructure. Digital twins, virtual replicas of physical assets, allow operators to simulate and optimize performance under varying conditions, reducing costs and improving reliability.

Analytics drive better decisions

Data and analytics are transforming decision-making in power generation by providing actionable insights into operations and market conditions. Predictive analytics can forecast demand patterns, optimizing generation schedules and reducing waste. Machine learning models identify inefficiencies in energy production, helping operators adapt to changing grid requirements and maximize profitability.



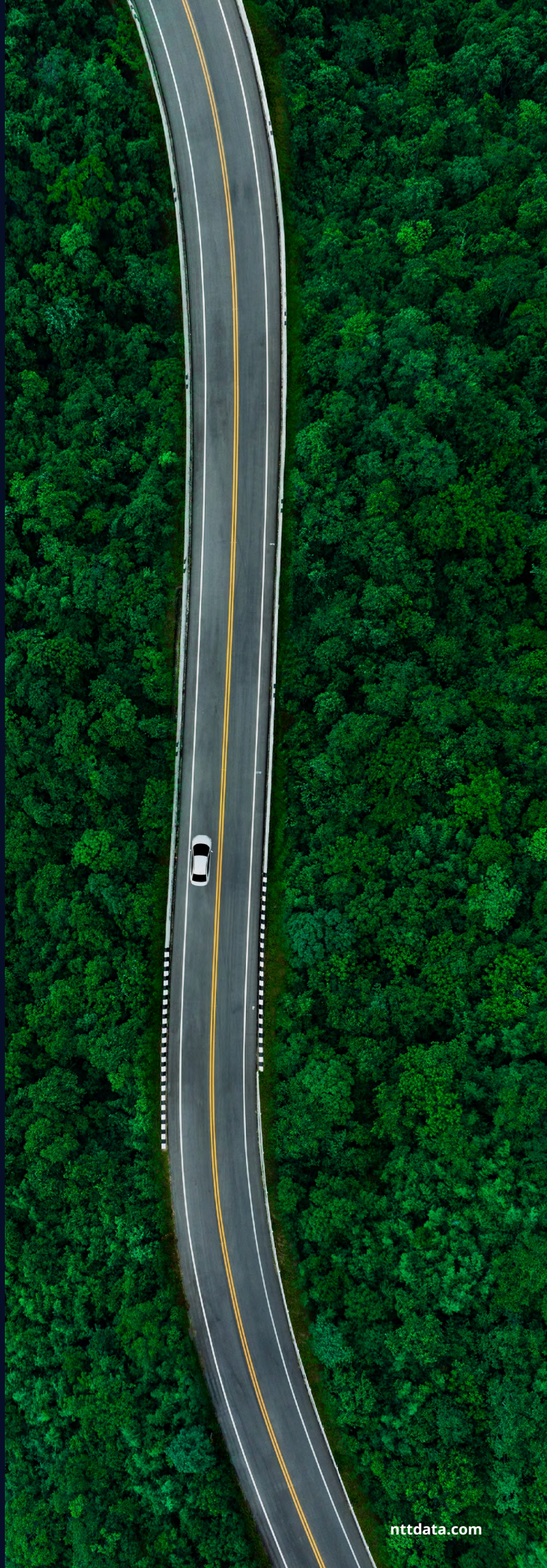
Transmission and distribution networks

The rise of distributed energy resources (DERs) like solar panels, energy storage systems, and electric vehicles necessitates advanced grid management. Smart grids equipped with AI optimize the integration and deployment of DERs, ensuring stable power delivery even with fluctuating supply. This enables utilities to meet growing energy demands while maintaining grid reliability.

Asset management in transmission networks has evolved through the integration of AI and IoT. Smart sensors continuously monitor the condition of transformers, substations, and cables, providing real-time data on performance and potential faults. AI-driven analytics identify patterns in asset wear and predict failures, enabling pre-emptive maintenance and reducing repair costs.

Real-time optimization

Dynamic network operations rely on advanced sensorization and integration with real-time platforms to enhance performance. AI systems process vast amounts of data from network sensors, allowing operators to quickly detect and resolve issues. This capability is particularly crucial in managing modern grids that must accommodate renewable energy sources and variable demand patterns. Advanced visualization tools further empower operators to make data-driven decisions in real time.



Trading

Against a backdrop of a more complex energy mix and growing price volatility, energy traders are under immense pressure to improve their strategies and operations to remain competitive and ensure market stability. Once dominated by trading houses and utilities, energy trading has now expanded to include DER operators and offtakers.

AI-Powered trading strategies

AI-driven algorithms can identify market trends and predict price movements with remarkable accuracy, offering traders a strategic advantage in stress scenarios. Furthermore, automation, guided by these insights, reduces the time required to execute trades, thereby enhancing operational efficiency and mitigating risks.

AI can also assist in optimizing investments in renewable energy sources by evaluating factors like weather patterns, regional energy demands and market regulations. Originating a Power Purchase Agreement (PPA) or executing a hedge are some examples of common tasks where the AI can provide guidance. Additionally, GenAI simplifies data access by automating data cleaning, aggregation, and reporting processes.

> “Energy trading and risk management (ETRM) technologies not only support the operational demands of these participants but also transform the way they monitor KPIs, make decisions and optimize processes to ensure energy supplies while minimizing risk.”



Service stations

Over the years, service station operators have successfully repositioned themselves as convenience store operators, reducing their dependence on low-margin fuel sales and boosting basket sizes – up to 60% of their sales may come from non-fuel purchases. This shift has obliged operators to adopt the sales and marketing techniques of mainstream retailers, and to offer more efficient and personalized customer experiences.

The new needs created by the energy transition are now pushing service stations to further diversify their offerings to become multi-functional hubs, integrating biofuels, EV charging, and other sustainable energy solutions. As this evolution proceeds, digital technologies will play a critical role in boosting customer engagement and loyalty, and streamlining operations.

Real-time optimization

Generative AI introduces opportunities for enhancing productivity and customer satisfaction in energy retail. AI-powered chatbots and virtual assistants can provide personalized recommendations, process inquiries, and optimize the customer journey, in both a virtual and physical sense. These tools also help monitor inventory in convenience stores, reducing stockouts and optimizing replenishment schedules.

By analyzing customer behavior to offer tailored promotions and encourage uptake of loyalty programs, AI tools can improve engagement and drive repeat business. As EV penetration increases, offering a superior EV charging experience will become a crucial differentiating factor for service stations. Using AI, they can better predict demand patterns, optimize station locations and reduce wait times.

Commercialization of gas and electricity

The commercialization of gas and electricity is increasingly focused on integrating diverse utility offerings under unified platforms. Companies rely on pricing tools like Configure, Price, Quote (CPQ) software and Customer Relationship Management (CRM) systems to streamline customer acquisition and retention processes.

By adopting an omnichannel approach to customer interaction, service providers can ensure seamless communication across web portals, mobile apps and customer service centers. The aim is to achieve a consistent experience across all touchpoints while empowering customers with self-service options for account management and energy usage monitoring, so reducing the burden on traditional support channels.



Extracting more value with analytics

Business intelligence (BI) tools are widely used to extract value from customer and operational data. AI-powered analytics can take this process further by identifying patterns in energy consumption, enabling more accurate demand forecasting and tailored service offerings. These insights can also drive strategic decisions, from infrastructure investments to marketing campaigns, ensuring alignment with market needs and business objectives.

An AI-enabled future for the energy industry

AI is reshaping every segment of the energy industry, from exploration and refining to trading and retail. By streamlining operations, enhancing decision making, and fostering innovation, AI helps companies address key challenges such as operational inefficiency, market volatility, and regulatory compliance.

In addition, AI will play a key role in advancing the energy transition and enabling energy companies to meet sustainability goals. For example, AI-driven models for carbon capture and storage, energy storage optimization, and hydrogen production are poised to play significant roles in achieving net-zero targets.

Future advances in AI technologies will create exciting new business opportunities throughout the energy value chain, providing greater insight into new ways to optimize the production of scarce energy resources, and ensure their efficient distribution and utilization.

Getting started with AI

Adopting AI requires a comprehensive and well-efined strategy that aligns with organizational goals and market demands. Energy companies need to prioritize scalable AI solutions, invest in data infrastructure, and ensure workforce readiness through training and change management. Collaborating with technology partners and industry peers can also accelerate adoption and drive innovation. Success in leveraging AI depends on a balanced approach that integrates technology, expertise, and a commitment to sustainable practices.





Why choose us

NTT DATA brings unmatched expertise in empowering energy and utility companies to optimize processes with our portfolio of advanced technologies and services. We deliver essential guidance to help our clients tackle the strategic challenges of an ever-evolving energy sector, ensuring they stay ahead in a landscape of constant change.

By adopting more agile and data-driven operations and smarter infrastructures, using technologies such as GenAI, IoT and data analytics, our open innovation ecosystem enables you to develop solutions to expand your business portfolios and enhance operational performance.

Visit nttdata.com to learn more.

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