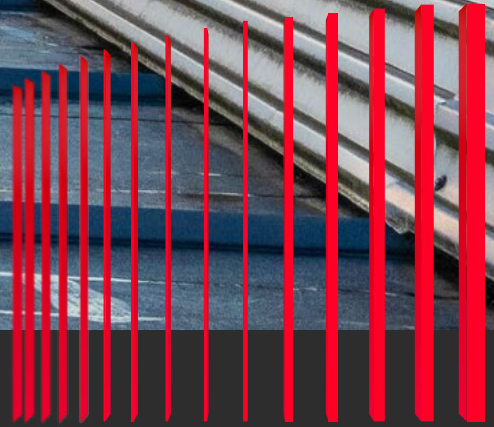




White Paper

Powering the Utilities of Tomorrow — Can GenAI Create a Multiplier Effect?

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Today's power utilities face a trilemma in which they must balance energy security, affordability and sustainability. At the same time, their sector is undergoing an upheaval driven by the three Ds: decentralization, decarbonization and digitalization.

Many forward-thinking industry leaders see AI and GenAI as potential solutions to these challenges, but those technologies raise urgent questions of their own:

- What role can GenAI play beyond the existing use cases currently being served through conventional AI (non-generative AI)?
- What role will the regulatory landscape play in supporting the effective application of GenAI in the sector?
- Will GenAI complement conventional AI use cases?
- How do utilities harness the good of GenAI while ensuring adequate guardrails to limit the potential downsides from its application?

In the past, risk aversion has kept power utilities from quickly adopting new technologies. But artificial intelligence (AI) is changing that. Conventional AI has already shown tremendous potential for the industry in optimizing operational performance,

ensuring grid resilience and security, and enabling integration of decentralized energy resources. For example, Duke Energy is leveraging AI to build new smart grid software and services on Amazon Web Services (AWS) and expand its Intelligent Grid Services — a suite of applications that will help the utility anticipate future energy demand and optimally address it.¹ Generative AI (GenAI) could create a multiplier effect by expanding this potential in these existing areas while also significantly improving the customer and employee experience.

While all of that is true, utility executives need to view and consider GenAI use cases through adequate guardrails to ensure that the technology is adopted in an ethical manner, that it ensures adequate privacy and security, and that it is compliant with regulatory mandates.

This paper addresses the questions and choices facing power utilities, providing a balanced perspective on the potential application of GenAI for the utilities industry and offering actionable insights so that C-suite executives can make informed decisions regarding GenAI adoption for the sector.

¹ "Duke Energy collaborates with AWS to develop smart grid solutions to better serve customers and drive its clean energy transition," Duke Energy News Center, November 17, 2022.

Conventional AI and GenAI — What's the Connection?

If utility CIOs are thinking about adopting GenAI, does this mean that conventional AI is being replaced? The short answer is no. Conventional AI and GenAI operate as complementary tools, working together to enhance various processes and applications. By leveraging the strengths of both technologies, utilities can achieve comprehensive and efficient solutions in areas such as content generation, data analysis, automation and user engagement. The key is to understand the specific use case and how each technology can contribute to achieving the desired outcomes.

Put simply, GenAI tools such as text generators and image generators are best at creating content. Other AI technologies analyze and derive insights from this generated content. Think of this as “number crunching.”

In use cases where there is an abundance of different data types (for example, sensor data, metering data and unstructured data), before data is fed into GenAI tools, conventional AI technologies can be used to preprocess and clean the data. In these cases, natural language processing (NLP) models such as sentiment analysis and text classification can clean and structure text data, while image recognition models can be used to ensure that image data is of high quality. In other use cases, GenAI-driven content summarization can be used to extract key insights and summaries from deep and wide data stores.

This makes it easier for decision-makers to quickly grasp the main points without going through large volumes of text.

GenAI may be the first analysis step in other types of use cases, when new insights or patterns are suspected but not yet known. Whereas conventional AI's strength is in classification, prediction and optimization, GenAI's ability to create new content and simulate humanlike patterns can uniquely benefit certain types of analysis. For example, GenAI can take digital assistants to the next level. Human speech has wide variances, and GenAI is uniquely capable of understanding these differences in real time and determining the best course of action.

But all of these GenAI strengths come with a caveat: Users of the technology must consider privacy, ethics and bias issues. Does GenAI create use case risk when it comes to privacy? Not necessarily. While it is important to understand the risks of leveraging public GenAI, it is equally important to understand that conventional AI might have a role in protecting privacy. For example, conventional AI technologies can be used to anonymize or pseudonymize data generated by GenAI tools. This is one approach to ensure that sensitive information is not exposed — an important consideration given the level of personally identifiable information (PII) that utilities store as they work to serve customers.

Leveraging these two important technologies in concert might be the right answer. The combination of GenAI and conventional AI can streamline processes, improve decision-making and enhance overall efficiency, enabling actionable results. Furthermore, CIOs can benefit from gaining familiarity with these tools so they can make decisions guided by informed and effective leverage, rather than preconceived notions that may not be applicable to the business problem being considered.



GenAI Use Cases — the Proof

GenAI generates new content, designs and solutions in real time by learning from diverse structured and unstructured data sources. It is particularly well-suited for use cases that require complex data analysis and summarization, pattern recognition, forecasting and optimization, which makes it ideal for helping utilities meet their objectives of improving sustainability, optimizing operations, and enhancing customer experience. It provides further value by empowering utility executives to achieve these goals efficiently and cost-effectively.



The transformative potential of GenAI can be seen in a few primary use cases for utilities, including:

Energy Efficiency and Demand Response

Energy optimization is a key area in which GenAI can produce tremendous impact, particularly with the increasing adoption of renewable energy sources coupled with the need to balance supply and demand. Utilities can use GenAI algorithms to leverage weather forecast data, historical consumption patterns, grid conditions and more to gain valuable insight. With these insights, they can optimize energy generation, mitigate renewables intermittency and manage demand response.

All this can also help utilities reduce carbon emissions to further their sustainability objectives. Additionally, dynamic pricing mechanisms can predict peak demand periods, encouraging people to switch their usage away from peak times, thus decreasing strain on the grid.

By analyzing weather patterns, energy generation data, grid conditions and forecasting methods,

GenAI models can create a form of renewable generation forecasting to help utility companies manage intermittency of renewable sources, improving the stability of the grid and maximizing the use of renewables.

Customer Engagement and Experience

Utilities have increasingly focused on improving customer engagement and experience. GenAI can help utilities achieve these goals by analyzing customer data such as billing history, energy consumption, demographic information and other data to generate personalized insights and recommendations. These recommendations help customers better understand their energy use while also identifying opportunities for them to save money and adopt sustainable behaviors. By employing GenAI, utility companies can also augment existing chatbots or virtual assistants to leverage in-context data on the fly to enhance the customer experience and optimize customer support costs, while also enabling revenue enhancement opportunities.

Grid Optimization and Resilience

GenAI also empowers utility companies to find innovative solutions for grid management and demand response by applying advanced analytics and optimization techniques. GenAI algorithms can comprehend complex data sets, recognizing consumption patterns and developing forecasting models (both generation and demand). These capabilities help utilities balance grid loads more efficiently and reliably, allowing them to make informed decisions that adapt to changing demand patterns while creating more efficient grids that predict potential failures and deliver greater reliability and resilience. GenAI can also simulate various stress testing scenarios to assess their effects on the resilience and reliability of grid operations.

Energy Portfolio Optimization

Utility companies must manage complex and evolving energy portfolios to successfully navigate the energy transition. GenAI can help utilities optimize their portfolios by taking into account factors like energy prices, regulatory mandates and environmental impacts. It can simulate multiple scenarios to help produce optimal strategies that help utility companies make informed decisions about procurement, generation and storage so they can maintain an increasingly sustainable energy mix at the right cost factor.

Issues to Consider for Scaling GenAI

GenAI is in its early days of adoption in the utility industry, with many utilities expressing an active interest in deploying GenAI proofs of concept (PoCs) or pilots. As the pace of GenAI increases, it is imperative to consider some key issues that will determine the future trajectory of GenAI and whether it gains resonance and delivers on its promise. These include:

Regulatory and Compliance Issues

The utilities market is heavily regulated, making the addition of GenAI technologies a further complexity for regulatory and compliance requirements. While the regulatory landscape around GenAI is still evolving, there will potentially be additional rules and guidelines regarding data governance and provenance, algorithm transparency, and equity/fair decision-making processes as they pertain specifically to GenAI. Industry organizations and regulators will need to give a significant amount of thought and consideration to complying with these additional regulations while ensuring that regulatory frameworks keep pace with the fast-evolving technology landscape of GenAI.

Explainability and Interpretability of GenAI Models

GenAI models can be difficult to interpret, and they can be quite difficult to explain to the general public. These models are often perceived as opaque black boxes, making their output hard to comprehend. In the utilities market, where transparency and clear explanation of the reasoning behind AI-generated output are key to successful deployment, this poses a significant challenge. This makes it an absolute necessity for the industry to develop techniques to explain and interpret outputs of GenAI models as well as those of conventional AI algorithms. Explainability is essential to establish trust in algorithmic model outputs among multiple stakeholder groups, including regulators and customers.

Cybersecurity and Data Privacy/Quality Concerns

As utilities become increasingly digitalized, the risk of cybersecurity threats and privacy violations increases significantly. Concerns about possible exposure to cybersecurity risks through the usage of GenAI are genuine, but the technology can also help in preventing cybersecurity incidents. For instance, it can help detect anomalies, suspicious patterns (such as anomalous energy usage) and potential security breaches. This can enable utility companies to take proactive steps against fraud and cybersecurity incidents to safeguard critical infrastructure from cyber threats.

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Utilities companies collect large volumes of sensitive PII data, such as personal details and energy consumption patterns. This data is at risk when GenAI solutions are implemented, raising concerns over unauthorized access, data breaches and misuse. Adequate guardrails to ensure data encryption, access controls, and anonymization and protection of PII and other data must be implemented to address concerns on this front.

Where data quality is concerned, GenAI models will require large amounts of high-quality training data for domain-centric large language models (LLMs) in order to produce accurate outputs. Acquiring this data may prove challenging in the utilities sector because of privacy restrictions and limited access to diverse and comprehensive datasets. The industry must successfully overcome such hurdles to guarantee access to reliable training data to ensure that GenAI aligns with the industry's goals of regulatory compliance, data security and operational efficiency.

Ethical/Equitable Use of AI-Generated Outputs

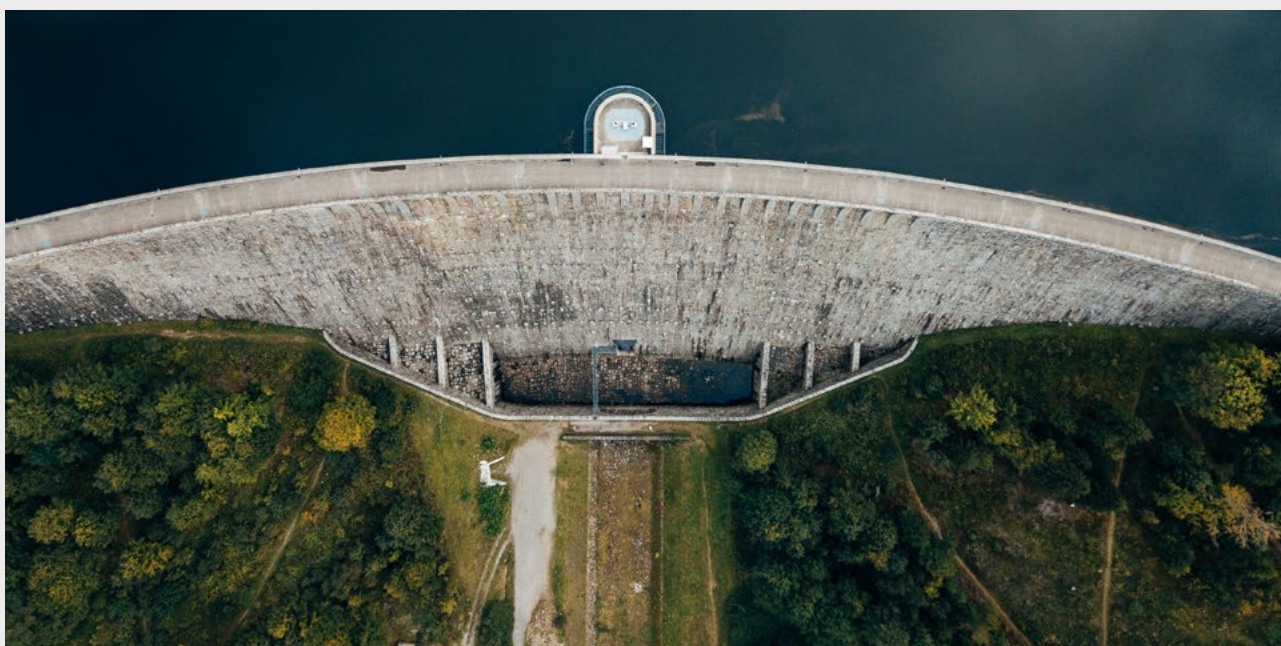
GenAI systems offer utilities companies an opportunity to use AI systems to influence decision-making processes in areas like load forecasting, energy optimization and demand response. Ethical and equitable use of the outputs produced by GenAI may prove difficult if biases present in training data produce outputs that result in discriminatory or unfair outcomes. Utilities companies must implement robust measures to proactively identify and mitigate potential biases present in training data that might skew decisions made using these AI-generated outputs and create unintended results. Algorithmic transparency and accountability will be key considerations.

Enabling Infrastructure

GenAI technologies will typically leverage a cloud-based infrastructure and will have to tap into a mix of legacy on-premises applications and cloud applications, which will

require a complex integration architecture. Organizations using GenAI must maintain compatibility and interoperability between these new cloud-native AI architectures and their legacy infrastructure. The advent of industry cloud offerings, which aspire to provide best-of-breed cloud-native functionalities and industry-focused functionality, is a significant development in this area.

The interplay of GenAI with industry cloud offerings will be a key evolution to watch for. Industry cloud solutions can enable utilities companies to develop the appropriate technological architecture and capabilities to maximize the full potential of GenAI in improving operational efficiencies and decision-making capabilities. From an adoption perspective, it may be worthwhile for utilities to consider a balance of high-impact yet risk-mitigated use cases that can leverage a private cloud architecture to ensure privacy, security and confidentiality.



Conclusion

AI and GenAI have tremendous potential for transforming power utilities. However, the industry needs to give adequate forethought to deployment and scaling issues to ensure that GenAI gains momentum and provides a multiplier effect to conventional AI use cases. Guardrails in the form of ethical guidelines, regulatory compliance requirements, privacy and security measures, accountability and transparency, and enabling infrastructure are needed to ensure that GenAI is deployed and scaled appropriately.

Utility companies that embrace GenAI with strategic planning and adhere to these guardrails can better leverage their rich sources of data to create a wide range of benefits that include grid resilience, sustainable energy solutions, and a new level of flexibility in response to rapidly changing supply and demand. With the right strategy, these organizations can leverage AI and GenAI to deliver on key industry goals and prepare for a dramatically evolving energy future.

Take the next step on your GenAI journey
and jumpstart your transformation.

[Learn more about solutions for energy and utilities in the age of AI. →](#)



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Rajesh Devnani

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Rajesh currently leads the Energy & Utilities vertical for Hitachi Digital Services. In this role, his focus is on delivering exceptional client value and success through building an industry centric GTM proposition leveraging the Digital Solutions portfolio of Hitachi Digital Services and the larger Hitachi Group.

He is a key member of the organization's Digital Solutions leadership team with a charter to drive exponential growth into the named industry verticals through a consulting-led, business benefits-driven approach leveraging the Digital Solutions portfolio and being a trusted advisor to clients. His charter is delivering differentiated world-class digital solutions leveraging the best capabilities of Hitachi Group across Digital technologies comprising Cloud, IoT and Data Science/Analytics backed by a strong industry domain and consulting capability in multiple industry domains.

His previous experience includes leading the Global Digital Solutions function and creating a comprehensive Digital solutions portfolio spanning Smart Manufacturing, Predictive Maintenance, Smart Cloud, Smart Spaces and Smart Transportation. Other past experiences include incubating and growing Operations Management Consulting, Business Intelligence and ERP Practices at Hitachi.

Rajesh holds an Electrical Engineering graduate degree and is an MBA from IIM, Lucknow. Rajesh also holds multiple professional certifications including CPIM, CSCP, SAP, etc., and is a speaker at multiple reputed professional forums.



Bob Lutz

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Bob Lutz leads the ISG Utility Industry practice. He has a comprehensive understanding of industry dynamics and trends. Bob has responsibility for understanding the changing industry landscape inclusive of macro factors such as decarbonization, distributed energy and digitization, and he is responsible for quality, client satisfaction, C-level relationships, project status management and reporting. Bob is an ISG Digital Expert.

Known as an energy and utility expert, Bob understands the importance of operationalizing external mandates and initiatives that impact the energy and utility industry on a daily basis.

His specialties are creative problem solving and the application of technology to lower costs, improve productivity, improve the customer experience and free funds for more strategic purposes.

Bob has led many teams on multiple client engagements and rolls up his sleeves on topics ranging from conducting negotiations between service providers, crafting approaches to Agile that work for utilities, supporting regulatory filings, audit-finding mitigations, developing capitalization strategies, and assessing and developing organizational approaches while balancing insourcing and outsourcing.

About Hitachi Digital Services

Hitachi Digital Services believes in the power of technology to improve people's lives today and build a better future. It's something we've done, as part of the Hitachi Group, for more than 110 years. We work at the intersection of people and technology, through trusted partnerships, engineering excellence and digital transformation. Let's accelerate your journey to tomorrow. Visit <https://hitachids.com/>.

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ISG (Information Services Group) (Nasdaq: IHI) is a leading global technology research and advisory firm. A trusted business partner to more than 700 clients, including more than 75 of the top 100 enterprises in the world, ISG is committed to helping corporations, public sector organizations, and service and technology providers achieve operational excellence and faster growth. The firm specializes in digital transformation services, including automation, cloud and data analytics; sourcing advisory; managed governance and risk services; network carrier services; strategy and operations design; change management; market intelligence and technology research and analysis. Founded in 2006, and based in Stamford, Conn., ISG employs more than 1,300 digital-ready professionals operating in more than 20 countries — a global team known for its innovative thinking, market influence, deep industry and technology expertise, and world-class research and analytical capabilities based on the industry's most comprehensive marketplace data.



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