



The Electric Utilities Industry Technology Trends Radar 2024

**Energizing the Future Faster: Strategic
Roadmap for Power Technology Trends**

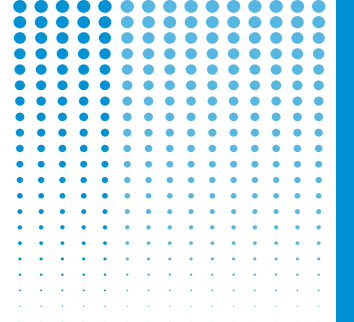


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Foreword



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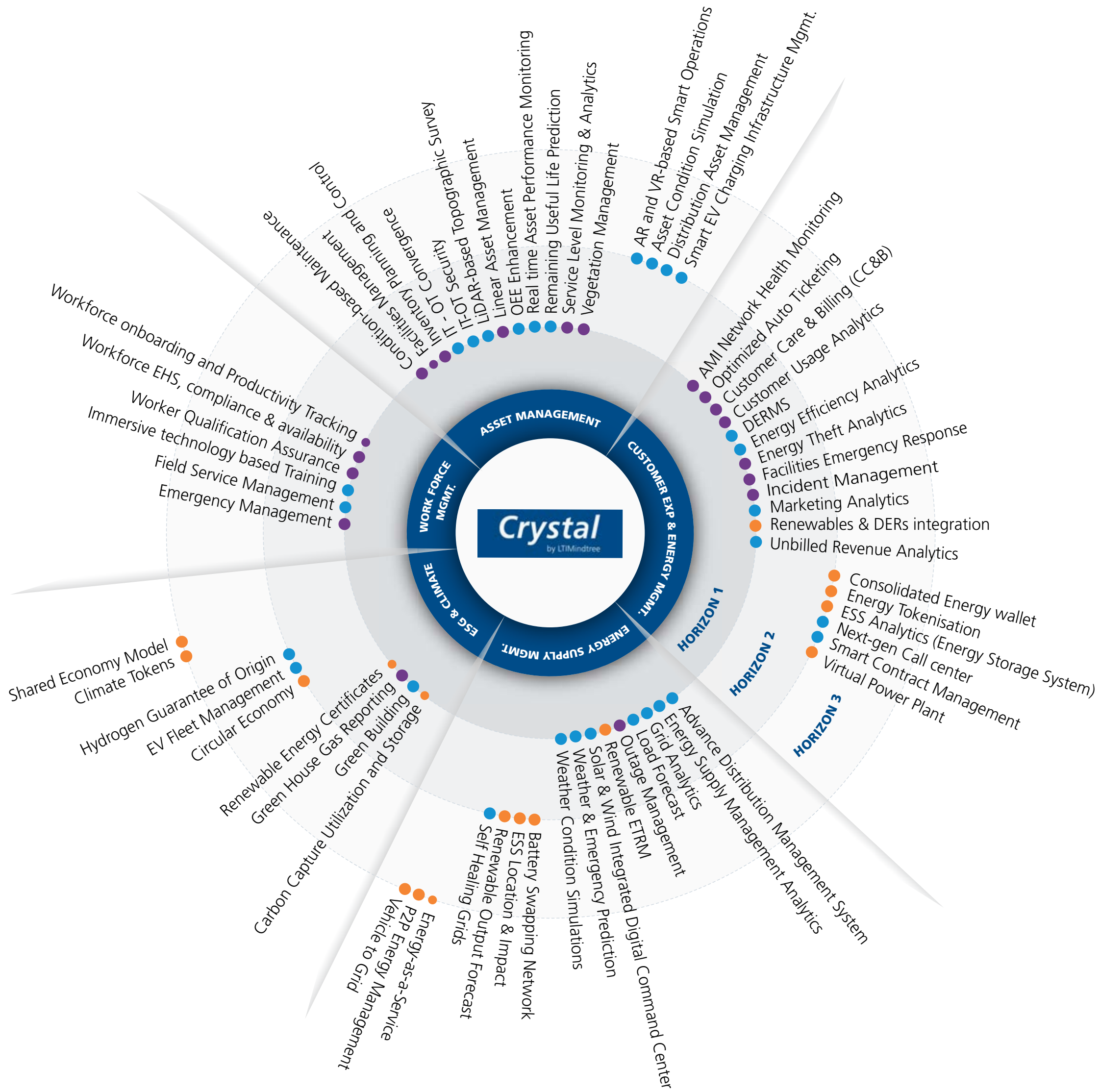
The Global Electric Utilities industry is undergoing a tectonic shift as it is at the center of the global energy transition to Net Zero. With the imperative of energy transition, the future is clearly Electric. The global electricity output is set to quadruple by 2050 as compared with 2020 outputs. The transition is already underway, with nearly 5 TWs of total capacity addition globally in the last five years. Unsurprisingly, renewable energy has contributed nearly 35% of this increase. This significant shift from fossil to clean energy is not only limited to electricity generation. T&D operators and energy supply players are increasingly leveraging **decentralization, decarbonization, digitalization, and innovation** as strategies for asset modernization, transformative customer experiences and innovative business models.

LTIMindtree's technology and industry experts have been closely observing the changes and view Digitalization and Innovation as primary levers for this transformation. They unlock the potential for utility companies to transform their operating models and reduce barriers to entry for new players. As an example, through the combination of Advanced Energy & Distribution Management Systems and Virtual Power Plants, utilities are evolving into new business models, enabling consumers to become prosumers, and bringing better shareholder returns. Using Generative AI, Design Thinking and Modern Apps, Utilities are delivering new energy products & services, transforming customer experience and enabling lean and agile operations. Using blockchain and predictive AI models, utilities are making intelligent predictive decisions for trading in an increasingly volatile energy market filled with uncertainties of supply and demand.

Technological innovations fuel the change, but customers' demands, regulatory pressures, and shareholder expectations are also increasing. Concerns around affordability and reliability of supply are growing, given the increased mix of renewables. It is the perfect time for Electric Utility companies to holistically re-evaluate and align their technology strategies to their business goals while remaining cost effective.

LTIMindtree's Crystal – Electric Utilities Industry Technology Trends Radar 2024 is the first edition of our report that presents a comprehensive view of emerging technology trends and their roadmap in the Utility industry. This report is a result of collaboration between our Global Technology Office and the Utilities Council. Our team of experts conducted rigorous research on the adoption of technological trends shaping the Electric Utilities industry.

At LTIMindtree, we believe embracing fit-for-purpose solutions is vital for Electric Utilities to streamline customer experiences and achieve operational resilience. Download our report today and unlock the power of beyond-the-horizon technologies to shape your organization's success.



Electric Utilities Technology Trends Radar



Adoption Phase

- **Emerging**

Technology trend is under R&D

- **Improving**

Technology trends creates all the hype and promotes innovation

- **Mature**

Technology trends is accepted by the masses

Horizon

- **Horizon 1**

The 0-1-year timeframe for the trend to be on the marketplace is the Horizon 1 trend

- **Horizon 2**

The 1-2-year timeframe for the trend to be on the marketplace is the Horizon 2 trend

- **Horizon 3**

The timeframe of over two years for the trend to be on the market is the Horizon 3 trend

Application Impact

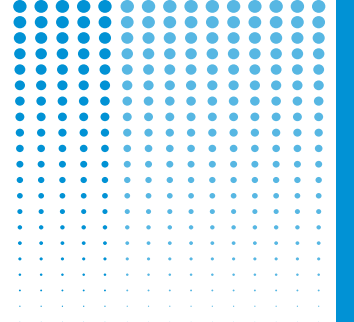
- **Low**

- **Medium**

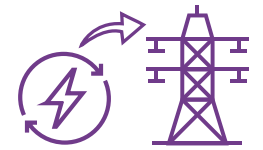
- **High**

The likelihood of the technology trend to generate value across Utilities - Power segments

Rating Parameters and Definition



Key Trends Decentralization



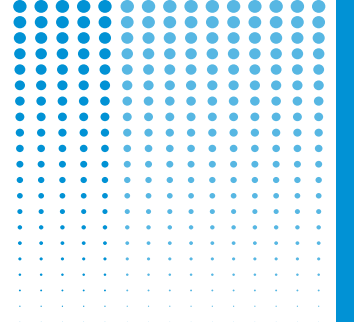
Renewables & Distributed Energy Resources (DER) Integration

Why Is It A Gamechanger?

A Renewable distributed energy resource (DER) operates and generates power in a small local setup and is connected to a larger power grid. Integration of renewables and DERs enables end-to-end management and orchestration of resources from planning to control. Implementing renewable DERs decreases energy waste, increases grid resilience and energy efficiency, and reduces carbon emissions.

Opportunities

Renewable distributed energy resources offer utilities multiple benefits, including supporting decarbonization and improving resilience. Renewable energy is sourced from multiple sources rather than a single source, reducing the likelihood of a large-scale power outage. Therefore, in the event of an outage, customers are more likely to be able to rely on renewable DERs. Renewable DERs are the energy of the future due to their capacity to operate through a grid not subject to natural environmental issues. According to the Frost & Sullivan Analysis, annual investments in renewable distributed energy resources will increase by up to 75% by 2030.



Key Trends Decentralization

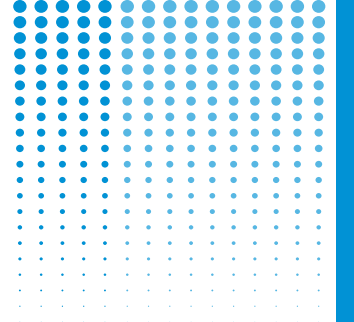
Advance Distribution Management Systems

Why Is It A Gamechanger?

ADMS has significant potential value, benefiting utilities, consumers, and the energy ecosystem. It enhances the reliability of electricity distribution by detecting and responding to faults and reducing the impact of disruptions on consumers. It is essential for modernizing the electricity distribution system, improving grid resilience, and providing more sustainable energy to consumers.

Opportunities

ADMS will be vital in developing self-healing grids, with advanced analytics, sensors, and automation quickly detecting and responding to grid issues. As the adoption of Distributed Energy Resources (DER) grows, ADMS will enable seamless integration and management, ensuring grid stability for utilities. These systems include functions that automate outage restoration and optimize the performance of the distribution grid. ADMS will enable advanced applications like Integrated Volt, VAR Control (IVVC) and Conservation Voltage Reduction (CVR) to reduce peak load by lowering system voltage to acceptable values.



Key Trends Decarbonization

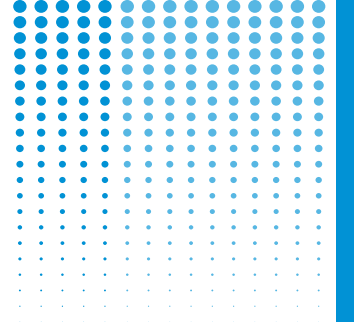
Hydrogen Guarantee of Origin

Why Is It A Gamechanger?

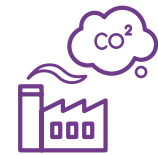
Hydrogen guarantee of origin enables organizations to monitor the origin of hydrogen from production to usage that ascertain its renewable sourcing and environmentally synergetic production practices. Methods for tracking must be transparent, applicable to a range of technologies, and broadly consistent with international approaches.

Opportunities

Efficient hydrogen production technologies with low emissions are advancing rapidly, yet additional focus is required to bolster the consumption of hydrogen. It has capabilities to enable producers to make credible low-emission claims about their products, unlocking opportunities for trade, decarbonization, and investment. Data from the producer and consumer is the key to verifying and tracking emissions associated with hydrogen production to establish the Guarantee of Origin.



Key Trends Decarbonization



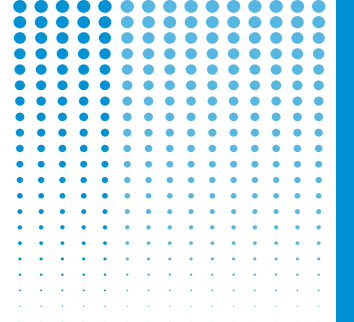
Green House Gas Reporting

Why Is It A Gamechanger?

The power sector uses fossil fuels and biomass for electricity generation. With the help of greenhouse reporting, power plants can report emissions directly and also other indirect emissions. Reporting of GHG emissions can drive change and improve the environment that utilities must take to mitigate climate change impact.

Opportunities

Greenhouse gas emissions reporting is an excellent opportunity to identify areas for savings through energy efficiency measures. It provides transparency to help businesses understand and reduce their costs. Greenhouse gas reporting tools generate insights highlighting significant emissions sources. Companies can use this data to prioritize actions for reducing carbon emissions.



Key Trends **Digitalization**



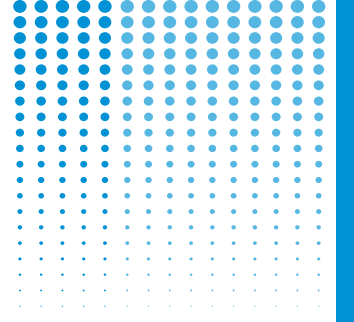
Real-Time Asset Performance Monitoring

Why Is It A Gamechanger?

Real-time monitoring of asset performance minimizes the risk of unexpected equipment failures. It enables timely maintenance and rapid response to outages, delivering a more reliable grid. It also helps power companies meet regulatory and compliance requirements by ensuring assets operate within specified parameters and conditions. Reduced downtime and energy consumption contribute to a lower environmental impact, in line with emission reduction goals.

Opportunities

Power plants and grid infrastructure will be equipped with digital twins. Real-time monitoring will ensure that the digital twin accurately represents real-world assets, allowing for detailed analysis and simulation to optimize operations. Edge computing and real-time monitoring will work in tandem, enabling faster data analysis and decision-making at the asset level. This will be essential to ensure grid reliability and security. Small, interconnected groups of robots will perform large-scale inspection and maintenance, covering large areas in less time.



Key Trends **Digitalization**



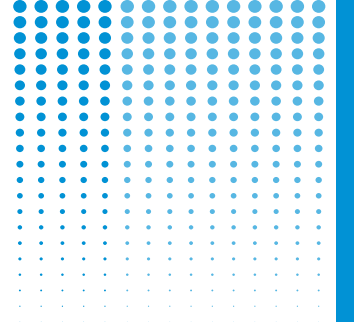
Energy Storage System (ESS) Analytics

Why Is It A Gamechanger?

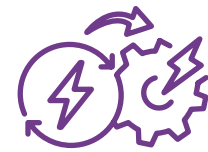
The energy storage analytics contribute to enhancing the stability and resilience of the electric grid. By monitoring grid condition, analytics algorithms can predict and respond to potential grid disruptions such as voltage fluctuations or frequency deviations. By analyzing historical data, weather patterns, and energy demand forecasts, analytics can determine the most efficient times to charge and discharge the storage system, ensuring cost savings.

Opportunities

Energy storage analytics will become more sophisticated and will be capable of accurately predicting energy demand, renewable energy generation, and storage system performance. By leveraging AI and ML algorithms, advanced analytics can optimize the charging and discharging cycles and anticipate grid conditions. It can enable energy storage systems to participate actively in energy markets. By analyzing market signals, price fluctuations, and regulatory frameworks, analytics can optimize the operation of storage systems to maximize revenue generation.



Key Trends **Innovation**



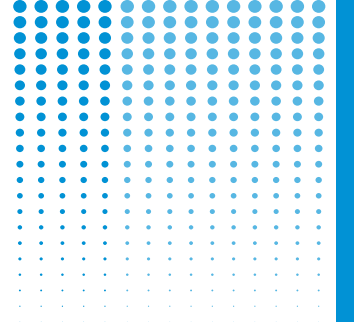
Virtual Power Plant (VPP)

Why Is It A Gamechanger?

VPP is evolving as a revolutionary trend in the power industry. It allows smaller groups to participate in power sharing or demand and earn compensation. These grids can also conserve energy for future demand. A VPP could act as a viable power solution for today's changing power demand, especially when the use of EVs is rising exponentially. The rising use of EVs requires a higher power supply, and in this scenario, VPP could be a game changer.

Opportunities

VPP can help cater to the power demand of rural areas where power companies have limited grid infrastructure. This can lead to reduced carbon emissions and dependencies on fossil fuels. The only factor hampering the adoption of VPP is the higher initial cost. Therefore, focusing on technological advancement with required research and development can reduce this issue.



Key Trends **Innovation**



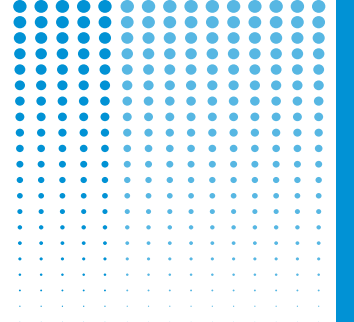
Energy Tokenization

Why Is It A Gamechanger?

Tokenization leverages blockchain technology to convert tangible assets into digital tokens, ensuring security across power trading cycle. This innovation expedites contract processes and eliminates intermediaries in cryptocurrency transactions, making it crucial in the future of the energy sector. In addition, it fosters transparency, enabling investors to monitor energy flow and ensure more green power generation and usage practices.

Opportunities

Tokenization holds immense potential for the energy sector, offering numerous advantages like improving accessibility, liquidity, and decentralization. Tokens based on blockchain enable the way for consumer-to-consumer energy transactions, bypassing traditional companies. Tokenization can streamline energy industry processes, cut costs, and boost overall efficiency. Tokenization of Real-World Assets (RWA) on the blockchain can revolutionize the energy sector making it more decentralized, transparent and sustainable.



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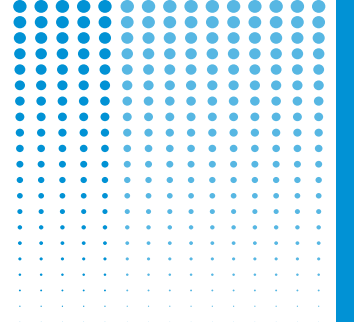
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Getting to the
future, faster.
Together.

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