Internet of Things in Power

Electrical Power Utilisation and Safety

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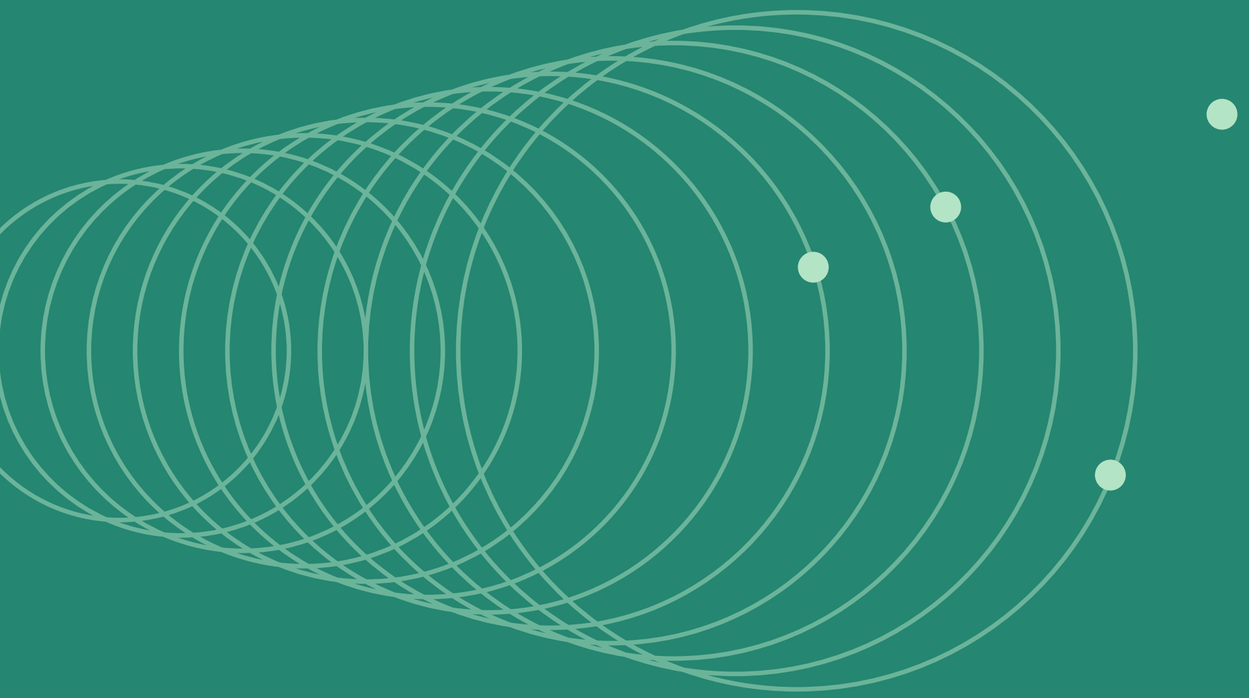
Agenda



Introduction

IoT in Power Sector

IoT in Energy distribution

Case Studies

Challenges

Opportunities

Introduction

An IoT is a network that connects uniquely identifiable ‘Things’ to the Internet. The ‘Things’ have sensing/actuation and potential programmability capabilities. Through the exploitation of unique identification and sensing, information about the ‘Thing’ can be collected and the state of the ‘Thing’ can be changed from anywhere, anytime, by anything.

Drivers of IOT

Inexpensive and high-power sensors and communications

Maturity and standardization of cloud computing, artificial intelligence and security

Explosion of IOT

Standardization of TCP/IP and use of IPv6

Components of IOT

Edge Devices	IoT Hub	Storage	Analytics	Actions and Presentation
• Disparate devices and technology • Devices used to generate real time data	• Entry point for the data into the platform • Exit point for all the commands to actuators	• Incoming datasets are stored in a variety of data storage methods	• Wide variety of data analytics is performed on the data	• The final component that contains a variety of applications, dashboards, integration with ERP applications, and variety of alerts & decisions
• Sensors • Gateways	• Data Hub • Event Hub • Service Bus • External data sources	• SQL Database • No-SQL Database • Blob Storage • Document Storage	• Stream Analytics • Machine Learning • Other Algorithms	• Apps • Notifications • Dashboard • Integration services

THE IOT IN POWER SYSTEM

- Blackouts and load forecasts are the two biggest problems with the electricity grid. In India, the transmission process results in a loss of more than 30% of the electrical energy.
- Power system blackouts can result from transmission system fault situations; this defect is typically rapid and difficult to pinpoint.
- The IoT is extended in load forecasting, one of its most alluring applications. To support this IoT-based smart load forecasting, all utilities in the European Union (EU) should now be required to have smart metres.

THE IOT IN POWER SYSTEM

- In addition to line state monitoring, IoT technology is used in overhead transmission lines to enhance perception of the power transmission line's operational condition, which includes weather conditions, ice cover, ground wire breeze vibration, conductor temperature and sag, transmission line windage yaw, tower inclination, and others.

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Load Forecasting

- It requires extracting usage patterns for electricity out of load curves. It can be done using classifiers that can identify devices in the load curve. To create such classifiers, the overall load of a microgrid is measured along with load curves by single devices.
- Classification can be more effective if smart devices which can record their consumption are used. Hence, classification in the initial learning phase of the smart microgrids is not needed. Adding forecast information to local energy production planning can lead to significant cost reduction, even if the rest of the grid contains no other smart devices.
- It is also very important in the integration of renewables into the grids. For instance, it is possible to increase the solar power penetration if suitable measures are taken concerning solar radiation forecasting.

Dynamic Pricing

- Dynamic pricing is assumed to be the next pricing policy, as utility companies can give incentives to consumers to balance the overall load. It is assumed that smart devices are the building blocks of future smart microgrids. A smart device should have the following abilities:
  - Control its consumption while fulfilling its local goals
  - Communicate with other devices within the microgrid
  - Behaves collaborative to achieve a global goal

- An important tool required for dynamic pricing is a smart meter. The metering device is the interface between the local microgrid and the grid of the utility company.

Smart Meters

- The smart meter is a device which is fixed to the consumer side of a smart grid network. Smart meters must allow integrating devices that can act in both roles, e.g. an electric car that can be used to store energy to compensate energy needs at peak or when the price is high.
- A digital two-way smart meter enables two-way communication between utilities and customers. It records electricity usage and reports it to the central utility. The load functions map a load to each point in time.
- Energy production is modeled as negative load. In addition, it provides real-time power consumption data to users through a web browser or mobile app, helping them make informed load usage choices, achieving demand response management for the utility.

Challenges

Investments

require investment to unlock the monetary and societal benefits. IoT investments at generation plants and transmission and distribution networks

Regulations

regulatory framework will have to address: cybersecurity, data privacy and interoperability.

workforce retraining

open up new jobs in higher skill areas like hardware designers, software engineers, data scientists and others.

Customer Expectations

to encourage electricity users to adopt these technologies and to enjoy the benefits of IoT in terms of lower electricity bills and higher reliability.

Challenges (in depth)

01 

Investments

Investment will be required to realise the monetary and societal benefits of IoT deployment and rollout. To increase reliability, efficiency, and emissions, IoT investments at generation plants and transmission and distribution (T&D) networks would have to be supported by government-owned utilities. Investment in IoT could become a cost of doing business for independent power producer (IPP) plants.

02 

Regulations

Cybersecurity is a moving target, and policymakers may be paralysed into either adopting draconian standards that lead IoT initiatives to stall because they are unimplementable, or setting the bar too low. Policymakers must establish criteria for the collection, storage, access, and use of this data. Regulatory organisations can facilitate the quick and easy deployment of IoT by defining standards for IoT device and system interoperability.

Challenges (in depth)

03

Workforce Training

Large technological advances result in significant productivity gains and market disruptions, resulting in significant labour force dislocations. IoT has the ability to eliminate some repetitive professions while creating new jobs in higher skill sectors such as hardware designers, software engineers, data scientists, and others. Satisfying this need would necessitate a significant shift in workforce education and training.

04

Customer Expectations

The difficulty will be to persuade middle- and lower-tier electrical customers to adopt these technologies and reap the benefits of IoT, such as cheaper electricity prices and improved reliability. The issue for utilities is to ensure that investments in IoT ultimately result in lower tariffs for middle- and lower-tier consumers, regardless of whether the investment is for operational optimization, asset performance management, or customer engagement.

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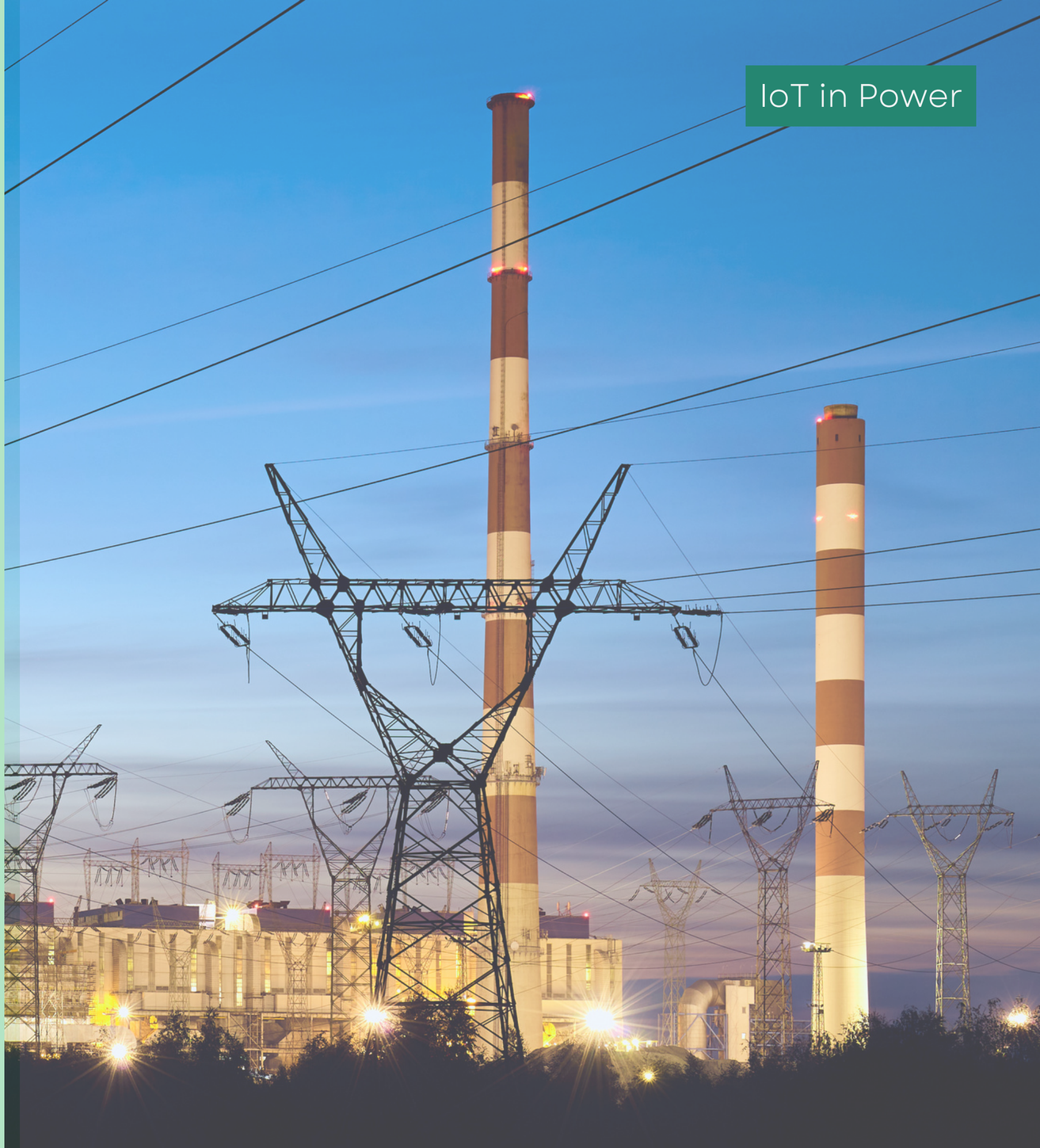
How IoT helps Energy Distribution Industry?

- Equipment Maintenance
- Burglary detection & Dynamic Charging
- Environment friendly power Management
- Power Rerouting and Restoring

Equipment Maintenance

Sensors included in IoT enable utilities to monitor the performance of power plants and other resources such as transformers.

This data can be used to manage the hardware throughout both its uptime and personal time activities



Iot in Energy distribution

Burglary detection & Dynamic Charging

Detecting electricity theft via wiretapping becomes easier for experts.

Along with this arrangement, smart metres enable energy companies to track the amount of electricity consumed by residences over time.

Iot in Energy distribution

Environment friendly power Management

The generation of electricity from non-environmentally favourable power assets pollutes the metropolis.

Nonetheless, endless riches are completely dependent on climate conditions, making them variable in nature.

Iot in Energy distribution

Power Rerouting and Restoring

Power transmission cables frequently fail due to rapid changes in weather and overloading.

In such instances, a community may experience a blackout until the problem is identified and rectified.

Iot in Energy distribution

Opportunities

- In Asia’s power sector, grids are plagued with unreliable service and are struggling to upgrade power systems to keep up with high demand growth rates.
- The Internet of Things (IoT), billed as the next industrial revolution or Industry 4.0, has the potential to significantly transform the power sector by optimizing operations, managing asset performance, and engaging customers to lower energy cost.
- The power sector is already reaping benefits from early consumer-oriented IoT applications: smart meters and smart thermostats.

Thank You !

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