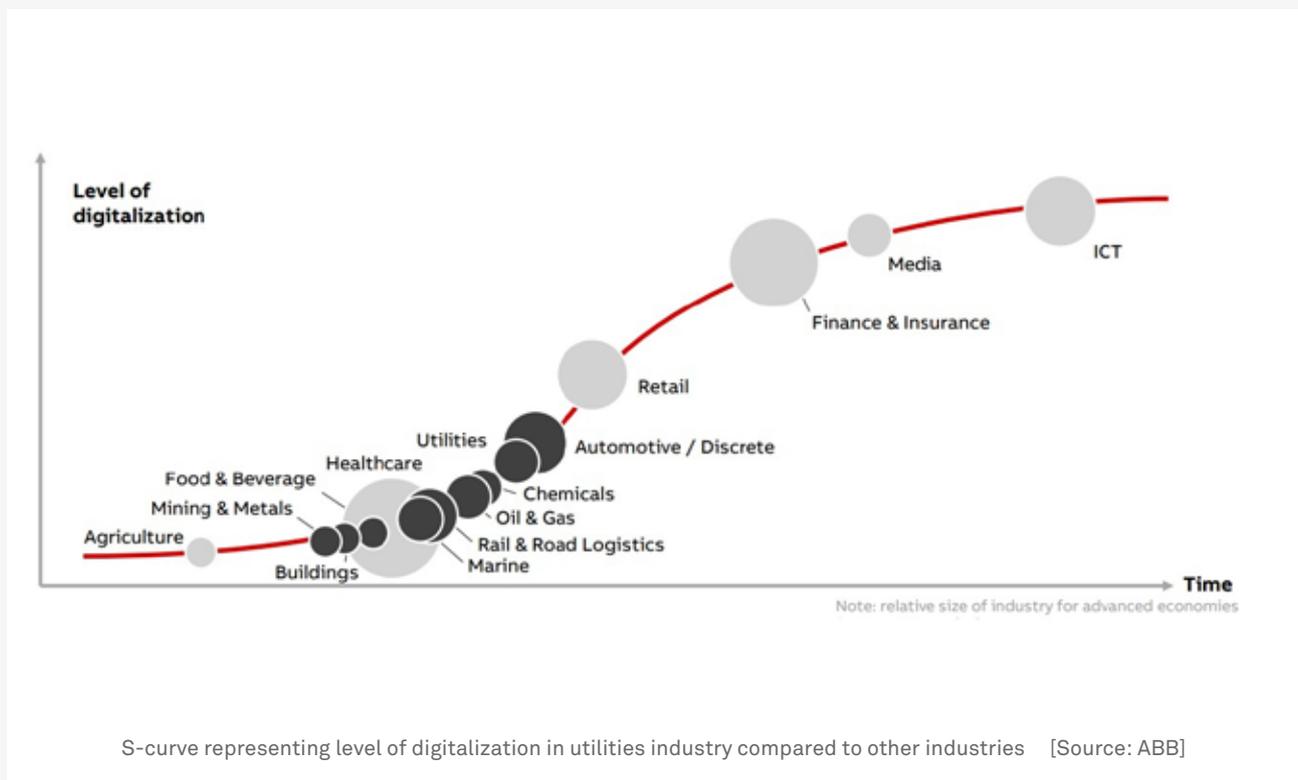# Digital Grid

Path to prosperity
for utilities

Electric utilities around the world are witnessing a big disruption to their established model of operations, caused by growing adoption of new technologies in power generation and consumption, and impact these technologies have on overall grid stability, revenue and cost models. At the same time, the utilities are facing headwinds on account of their aging asset base and workforce.

While almost all the major industries today are taking steps to digitalize themselves, the level of adoption of digital technologies in utilities is still at a nascent stage. The S-curve below represents how utilities fare against their peers from other industries when it comes to digital maturity.

This paper examines some high-impact use-cases for digital grid and enabling solutions powered by IoT and Data Analytics, which could help electric utility companies Do More with Less.

Level of digitalization

ICT

Media

Finance & Insurance

Retail

Automotive / Discrete

Utilities

Chemicals

Healthcare

Oil & Gas

Food & Beverage

Mining & Metals

Rail & Road Logistics

Agriculture

Marine

Buildings

Time

Note: relative size of industry for advanced economies

S-curve representing level of digitalization in utilities industry compared to other industries   [Source: ABB]

What Digital Grid means?

The grid infrastructure has largely been deprived of modernization in several decades, that too when it was never designed for a world where people use electric vehicles or operate their own micro-grids. The digital grid is expected to solve the challenges of seamlessly integrating conventional and renewable sources, storage, and centralized and distributed generation.

Digital technologies enable the entire network to be more aware and responsive by facilitating better communication flow between various entities in the demand and supply side network. The control, automation and even more importantly, the insights across the operations empowers the utilities to improve grid's reliability, availability and efficiency.

How digitalization can help utilities

Traditionally, monitoring & control systems installed for electric transmission & distribution management have been closed proprietary systems in a multi-vendor environment. The point solutions provided by each of the vendors mostly work in silos with limited interoperability and lack the required integration with the larger ecosystem.

For example, over the years, many electric utilities have invested in advanced metering infrastructure (AMI), Distribution Automation (DA) and Advanced Distribution Management Systems (ADMS). However, the data stream from these systems is hardly integrated with grid-side data streams or any other external data sources leveraged by utilities.

The initiative of Digital Grid aims to overcome this problem with interconnected controllable devices on the edge, common enterprise grade data platform and advanced analytics software applications for critical insights and actions.

Broadly, the use cases that would drive higher success rate and better ROI, would be the ones that would have the following objectives in their horizon.
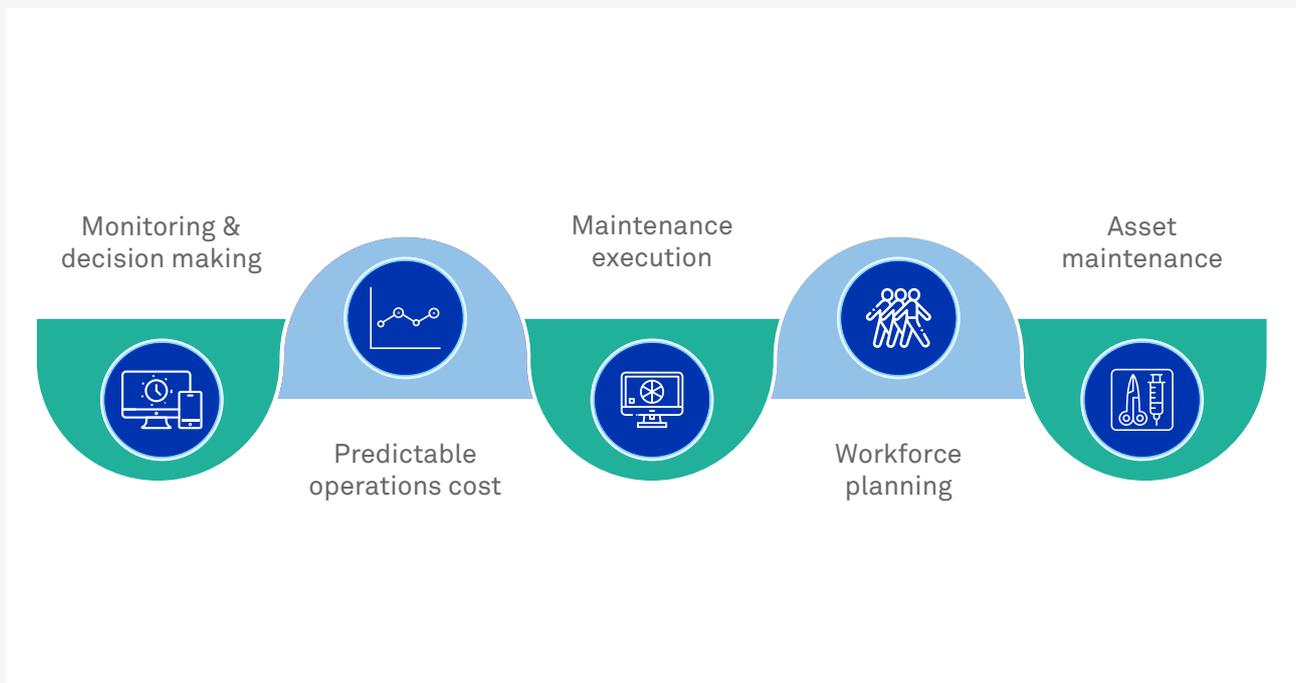
These objectives also ensure that the initiatives taken within the organization focus on some of the key drivers towards: enhancing customer experience, reducing cost, improving operations, improving reliability, increasing utilization, and improving overall predictability.

Use Cases for realizing digital Grid

Intelligent Asset Management

- Plug-n-Play support for onboarding new devices surpassing the barriers of multiple communication protocols at various levels in the utility network

- Distributed local edge level control rather than centralized system for metering, protection, monitoring & control devices

- Need-based approach toward asset maintenance supported with real-time asset health insights

- Improving the budget planning (both CapEx and OpEx), in terms of using the actual asset condition toward allocating budgets through outage planning, regular maintenance, inspections, spare parts, and inventory levels.

Intelligent network management

- Energy aggregation platform for managing Distributed Energy Resources (DERs)
- Real-Time energy demand and supply management platform for optimal network performance management
- Remotely control the consumer side energy demand against a fixed power generation capacity instead of purchasing more and more power based on demand

Intelligent services management

- Energy Management services for residential, commercial and industrial customers
- Innovative commercial models to reward responsible energy consumers
- Connected Workforce for overall operational efficiency improvement

How IoT and analytics together can enable digital grid

As the world around us keeps getting smarter with the advent of new technologies, it is natural that utilities need to adapt themselves to technological disruptions. In the past, most of the utilities have been using IoT and Analytics in some form or the other to address their specific challenges. The need of the hour is an Integrated Approach towards grid operations, maintenance, planning & finance, and supply chain.

IoT can enable the utilities to build a layer of intelligence on top of their existing asset base by integration of external sensors and communication modules, this will also ensure that assets could be monitored, diagnosed and controlled remotely. Substations are known for having a very complex asset base connected over different communication protocols e.g.

IEC60870-5-101/102/103/104, DNP, Modbus, IEC 61850, etc. Similarly, when it comes to the distribution side network, an array of wireless protocols like 6LoWPAN, Wi-SUN, ZigBee, BLE, WiFi, LoRA, etc. are being followed for AMI (Advanced Metering Infrastructure) management.

In order to simplify the data collection and exchange across multiple systems in the transmission and distribution network, open communication protocols (e.g. OPC-UA) can help bridge the disparate data sources and create a data lake that acts as a single source of truth for all stakeholders.

Once the data lake is set-up with structured and unstructured data aggregated from IT systems and OT sources, big data analytics engine can analyze and correlate the real-time/historical data sets to generate required business/technical insights and trigger decisions/actions. The data would then help build various models toward better decision-making and better prediction of operations and costs, e.g.

Asset risk models: Identify the risk of an asset failure, measured as probability of failure on demand (PFD) and its overall impact on the whole network. Once risk is identified, it will also provide recommended remedial action. The model will run in a closed loop i.e. the model will generate actions and output of actions will be fed back into the model again. This will also help the utility build more accurate digital twins of the network.

Priority models: Based on the asset insights, utility companies can decide the priority of maintenance needs across asset categories, allocate budget for maintenance activities and also plan for replacement of assets closer to their end of useful life.

Top level view of IoT platform for integrated approach to digital grid is given below.
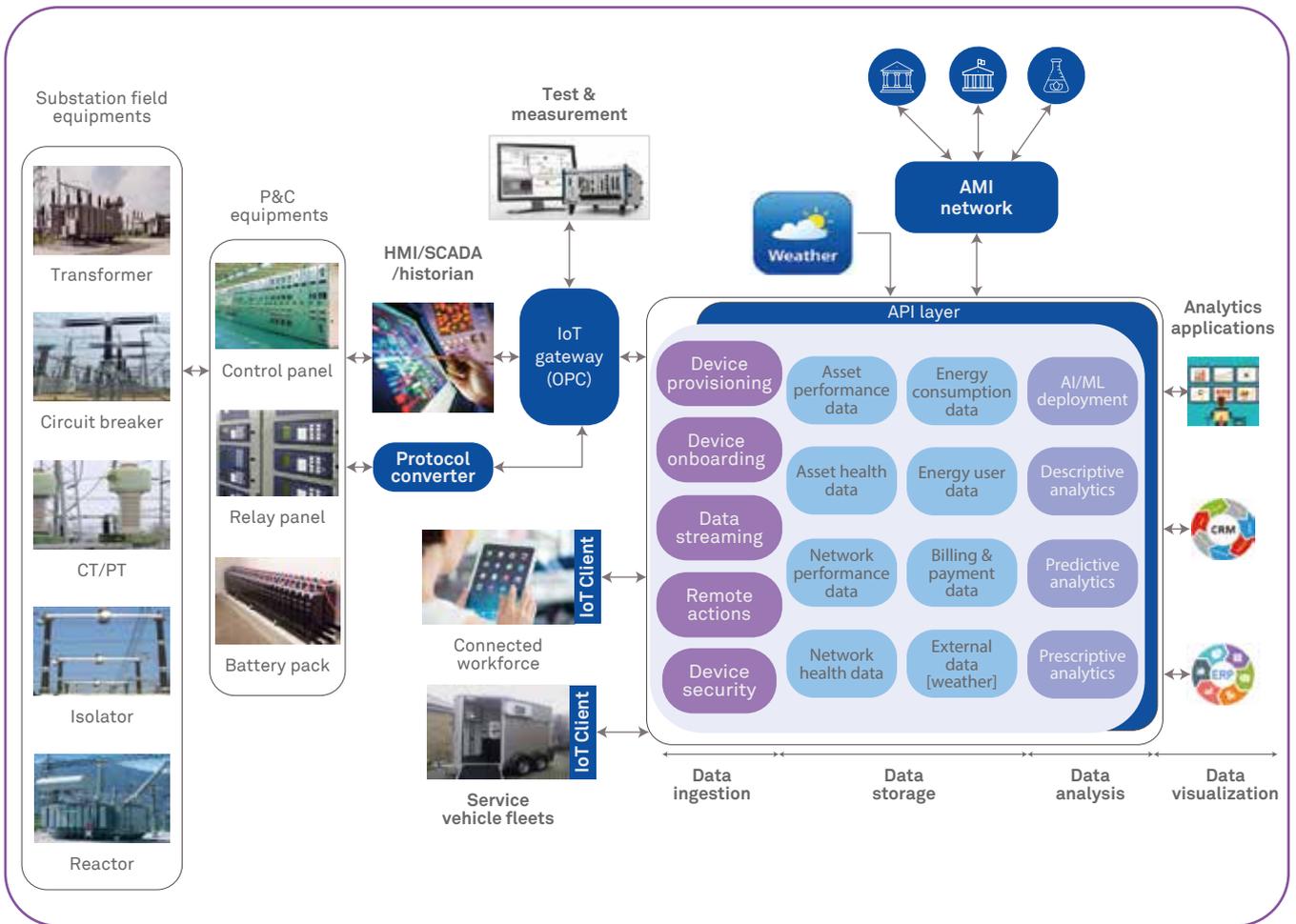
Some of the key IoT solutions which could be deployed for quick wins are

Condition-based Maintenance: Analyze health for critical assets e.g. transformers, circuit breakers, overhead power lines, etc., estimate their useful life, predict propensity to fail and initiate proactive maintenance to avoid unplanned downtime. Further to this, weather forecast data can be analyzed to anticipate any weather-linked readiness from the utilities side.

Dynamic Demand Control: Monitor the energy demand in near real-time, identify non-critical load operating in peak hours, provision for remotely switching off such loads on end-user premises and incentivize those customers who allow utilities to remotely control non-critical loads.

DER Optimization: Monitor the pattern of power fed from conventional energy sources e.g.

coal/gas fired power stations and DERs like Solar, Wind power, etc. and correlate the actual capacity vs. planned capacity and actual utilization vs. planned utilization in near real-time.

Data Driven Planning: Analyze the historical supply and demand data to forecast the energy requirements during the year, correlate this insight with health score of transmission & distribution infrastructure, accordingly plan to either invest in the infrastructure or toptimize the demand.

Enterprise Asset Management: Track & Trace capabilities for all types of high-value moving assets (e.g. test & measurement equipments, service tools & spare parts, vehicle fleets, workers, etc.) in indoor as well as outdoor environment. It brings consolidated benefits in improving operation efficiency, asset utilization and compliance to regulatory requirements.

Customer engagement: Invest in smart energy metering to collect vast amount of consumer-side data on energy demand, energy consumption pattern, various load profiles, etc., this will enable utilities to offer personalized services related to energy management. Analyze customer feedback from various sources including social media feeds and develop a bi-directional channel to remain engaged with consumers.

Why wipro is the right partner for utilities

Wipro has invested 14 years assisting Electricity, Gas and Water Utilities across 4 continents, helping them explore fresh ways to look at technology and modernize. Our proven industry expertise coupled with digital innovation and flexible as-a-service models continue to place our clients in a leadership position. Wipro's innovative domain solutions and business transformation accelerators address:

- Generation & Renewables
- Transmission & Distribution
- Smart Metering and Smart Grid Technologies
- Customer Billing and Retail
- Energy Trading & Risk Management
- Environment, Health and Safety

Conclusion

Digitalization for utilities industry, powered by IoT and Analytics will help them transition to a model where they have a global view of their assets, processes, workforce and customers, which in turn will lead to higher productivity and efficiency and lower cost of operation.

However, utilities, challenged by the growing amount of learning required to leverage new technologies, need competent partners to deploy smart systems, improve customer engagement, integrate renewables, meet regulations, manage mergers and acquisitions, and control costs.

With over 3,500 utility professionals and engagements with more than 50 global utilities companies, Wipro brings deep and dependable domain knowledge to the execution of digital transformation programs. Utilities will have access to a 360° service portfolio backed by global experience to address every need in the Electric Utilities segment.

Our recent success stories

Work Management Solution for UK business of National Grid

Implementation of NV Energy's Enterprise Work and Asset Management program

IT-OT integration of network, process and technology for CLK Enerji at enterprise level

Digital Utility Solution as Service for NRGi to enhance customer experience

About the authors

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Gopa helps customers transform their digital business through connected world initiatives and technologies to drive unprecedented growth and efficiencies. Gopa brings a broad perspective with 22 years of combined sales, solutions and delivery experience that have taken him across borders (India, Saudi Arabia, Singapore, Japan and USA) and industries (Energy, Chemicals, Automotive and IT).

Anand Kumar
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Leading the IoT solution proposals to support customers across all industry segments and geographies, also responsible for joint IoT solution development proposals with strategic technology partners like Microsoft, Amazon, IBM, etc. Leveraging his previous roles at GE and Schneider Electric, Anand brings strong IT/OT expertise of 11 years covering industrial solutions across Power, Oil & Gas and Manufacturing.

Ashish Joshi
DMTS & Head – IoT Client Solutions

Distinguished Member of Technical Staff and head of client solutions for IoT in Wipro, Ashish has played both technology and business roles in his professional career spanning over 19 years. He brings with him in-depth experience in the space of IoT/M2M across various industries like energy, utilities, industrial manufacturing, telecom, and retail. Bringing this cross-industry domain and technology knowledge, identifying real-world challenges, and using this information to identify and solve customer problems are key passions for Ashish.

To learn more, please email to **gopakumar.gopinathan@wipro.com** and one of our Consulting Partners will contact you.

About DMTS

Distinguished Member of Technical Staff (DMTS), established in 2014, is Wipro's marquee program that celebrates technical leadership within the company. It is a career ladder for technologists who want to pursue careers in technology as against general management. DMTS has three levels; individuals can join as Senior Members, Distinguished Members or as Fellows. Technological contributions expected increase as one moves from Senior Member to Fellow. DMTS members are leading technologists and experts in their specific areas and are sought by clients and internal businesses alike for advice on technical matters. As part of the community they are expected to continue contributing to complex projects at the business unit level, publishing on a regular basis, speaking at leading conferences, filing for patents etc.

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For more information, please write to us at info@wipro.com