Overview

COVID-19 rampaged the Indian economy resulting in a steep fall in Commercial and Industrial power consumption. As the nation-wide lockdown ended, economic activity picked up.

As a result of that, power demand surged to an all-time high of 189.64 GW in January 20, 2021. While increment in power demand is a good sign for the Indian economy, it also means that the power sector continues to reel under deep stress. As the sector lags behind in the adoption of Digital, this stress continues to build up. Over the past two decades, the Ministry of Power has been introducing several measures with the aim of reviving the Indian power sector.

These measures have typically centered on customer satisfaction, operational efficiency, enterprise robustness and financial soundness. In 2020, significantly important policy measures were introduced, including amendments to Electricity Amendment Bill (2020) and Electricity (Rights of consumer rules (2020)). Some noteworthy measures introduced in the bill and the rules include, direct benefit transfer, electricity contract enforcement authority, national renewable energy policy, standards of performance, reliability of supply, consumer as prosumer, operational efficiency, metering, billing and payment and disconnection and reconnection. While there is enough policy push for implementation of these measures, timely adoption of key digital initiatives discussed below, to catalyze the envisioned transformation, will be crucial for their success or failure.
Blockchain based solutions can assist businesses in swiftly, securely and accurately obtaining the appropriate information required to make quick and effective decisions. Blockchain based solutions can be leveraged to reduce cost, waiting periods and avoid conflicts that exists today in the execution of trade agreements by enforcing terms of the agreement through smart contracts deployed on blockchain, thus ensuring the creation of a single, consolidated and immutable record of transactions available to trading parties.

DISCOMs and energy generators can unlock the huge potential of blockchain by being an early adopter (improving the way of delivering services guaranteeing robustness, security and scalability), the facilitators (creating a regulatory framework; setting standards for security and privacy; building trust and interoperability), the collaborators (enable widespread adoption, transparent information sharing of capabilities and data, and evolution of new business models).

The average technical and commercial loss of Indian DISCOMs is 24.88%\(^4\) compared to the global average of 8.3%\(^5\). As per a study published by Stanford, a reduction of loss by 1% from this level would mean a deduction of 1.23%\(^5\) in fossil fuel generation requirement. Advanced Metering Infrastructure (AMI) consists of a Smart Meter, associated communication devices and software systems to acquire and process the meter data. During COVID-19, lockdown DISCOMS with smart meters were able to bill about 95% of their consumers remotely\(^6\). It is also considered a foundational building block for a Smart Grid. India has planned to deploy 300m Smart meters in the next 3 years\(^7\).

The usage of advanced analytics and sophisticated weather forecasting models will improve demand and supply side forecasting, specially of variable renewable energy sources. Correlated with historical purchase data, DISCOMs can accurately predict short, medium or long term power purchase trends, thereby optimizing their power purchase portfolios.
DISCOMs can move to a Unified Revenue Management System to have a bird eye view of revenue operations of their entire consumer base. Some other significant advantages are easier accounts consolidation, seamless integration with digital payment avenues and greater insights into electricity consumption of consumers.

In the RAPDRP part A scheme launched in 2008, 1402 urban towns and cities with population of more than 30,000 (10,000 in case of special states) were selected for establishment of reliable and automated systems for sustained collection of accurate base line data, and the adoption of Information Technology in the areas of energy accounting. In 2014, Integrated Power Development Scheme (IPDS) was launched which subsumed the RAPDRP Part A scheme and extended the IT enablement to balance 4041 urban towns and cities. IPDS, however, only covered urban areas and the rural areas were excluded either with no or decentralized billing systems. Creation of a consolidated demand, collection and balance report for both urban and rural consumers continues to be a challenge. Factors like limited capability of the then implemented urban revenue management systems to handle complex tariff structures is no longer an impediment.

With decreasing cost of sensors which can be placed on the assets and the growing need to improve resiliency through improvements in reliability and reduction in operational costs with the goal of enhancing customer satisfaction, IOT will be a game changer.

EAM features such as Work Management, Asset management, planning and scheduling, supply chain and health and safety when integrated with SCADA, ERP and GIS can help utilities in maximizing the value of their assets. Asset Performance Management which utilizes advanced analytics to assist in better predictive and prescriptive maintenance is the need of the hour.

Asset-intensive electric utilities in India are reeling under deep stress created by operational inefficiencies amplified by the inability to realize the true potential of their assets. In January 2014, the International Organization for Standardization (ISO) released the ISO 55000 series of standards which defines an asset as a “thing, item or entity that has actual or potential value.”

IDC predicts that by 2025 there will be 55.7 billion connected devices worldwide, 75% of which will be connected to an IoT platform. It is also predicted that utilities will have the highest IOT endpoints. System reliability continues to be a pain area in the asset intensive power sector.
An integrated solution encompassing efficient drone operations, a robust data management platform and advanced analytics will help power and utility companies release true value for the efforts related to setting up a dedicated drone program. While drone technology comes with many benefits, the associated risks of weaponization and personal security are worth due consideration.

Application of drones or Unmanned aerial vehicles (UAV) is emerging across the power sector value chain. Drones support real time monitoring and in establishing “Golden records” helping manage the geographic spread of power assets. While other sectors like O&G, mining and agriculture have been using this technology to substantially increase their efficiency, the trend in power sector is picking up pace. Empowered by digital innovations such as analytics, AI and ML, IOT and high-end computer systems, new use cases in power sector such as Boiler inspection, Vegetation monitoring, Line, Transformer, solar and wind assets besides other critical asset monitoring are being identified frequently.

During the COVID 19 peak, where strict lockdowns were enforced, access to critical assets and plants turned out to be extremely challenging. While utilities came under the gamut of essential services, maintaining full workforce at critical plants was not possible in entirety.

A virtual power plant is a replica of a physical power plant where IOT devices are installed on the asset ecosystem and a virtual replica is created on a cloud to monitor and control the operations remotely. Powered by a good communication backbone, it makes remote operations streamlined.

As per an article published by powered-India, the virtual power plant market is expected to be worth $4.5 billion by 2024 which means that not only will it mean exponential growth of IOT devices but also benefit enabling stakeholders such as cloud service providers, analytics vendors, communication service providers as well as utility personnel.

We first need to understand what VR, AR and MR are. The core concept of VR is immersion, which means creation of a 3D virtual environment in which the user is completely immersed.

Applications of VR in the power sector are employee and field staff trainings and virtual site visits. AR is a technology that uses a technological equipment (for example a camera lens) to augment the real world around us and adds digital content in the context of the physical world. Some applications of AR in power sector are training of workforce and employees, remote assistance to field workforce in inspection, maintenance, assembly and other critical operations through AR headsets and glasses.

AR/VR in combination of edge devices can provide rich insights on assets, operations and maintenance management.

Virtual, Augmented reality (VR/AR)

Drones or Unmanned aerial vehicles (UAV)

Virtual Power Plants

Digital Initiative

Catalysts

Pain area

Impact

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As per information shared by Information and Technology minister, Mr. Ravi Shankar Prasad, as many as 529 federal and state government websites have been hacked since 2016\(^3\). It is estimated that utilities will have the highest number of IOT endpoints which means potentially high number of entry points for vulnerabilities. The Central Energy Regulatory Commission has been highlighting to grid operators and regulatory agencies the need to have a continuity plan in case of a cyber-attack and revamp their security infrastructure. The information technology act (2000) along with the 2011 rules also specify ‘reasonable security practices and procedures and sensitive personal data or information’\(^4\). However, there is still a lot of work to be done in this aspect by DISCOMs who are implementing various consumer centric initiatives. Further, the upcoming personal data protection bill is expected to significantly change data privacy and related security practices adopted by the DISCOMs to ensure that consumer data is protected. The draft bill mentions a Data Protection Authority (DPA) being appointed as the data regulator which shall ensure enforcement and compliance for this data protection act and have a mechanism for imposing penalties in the event of lapses by organizations.

It is evident that cyber security governance and technical safeguards deployed for infrastructure and operations would be key elements of a resilient power sector and mitigating the risk of cyber attacks.

SCADA and Energy Management System (EMS) has been implemented in all state transmission and regional grids while SCADA and Distribution Management System in distribution is still underway. National Electricity Plan (Volume II) on Transmission i.e. NEP-Trans\(^15\), the review of development of transmission system during 12th plan period and planning for the ongoing plan period 2017-22 and perspective plan for 2022-27 discusses the importance of use of emerging technologies to move from steady state SCADA EMS systems to dynamic monitoring of grid using Phasor Management Unit(PMU) and Wide Area Measurement(WAM) which can enable features such as Remedial Action Services(RAS), System integrated protection scheme(SIPS), adaptive islanding, self-healing grid. On the distribution front, the RADPRP scheme launched in 2008 was the biggest driver of SCADA implementation. However only cities with population of 0.4 Mn and annual energy input of more than 350 MUs\(^16\). With growing impetus on smart grids, ADMS (unification of SCADA, DMS and OMS) implementation is picking up momentum. Adopting emerging technologies will help move from steady state SCADA EMS systems to dynamic monitoring of grid using Phasor Management Unit(PMU) and Wide Area Measurement(WAM) which can enable features such as Remedial Action Services(RAS), System integrated protection scheme(SIPS), adaptive islanding and self-healing grid.
Endnotes

1. https://twitter.com/Sanjiv_Sahai/status/1355512337042558984
15. https://powermin.nic.in/en/content/national-electricity-plan-0