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The Utility of the Future

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Power is shifting to consumers

Digital is transforming companies across diverse sectors, societies and lives. All this is taking place thanks to the connected era of devices, human-machine interface, intelligent systems and products. The same is true for the power sector as well, which was traditionally asset focused and utility driven.

Electricity consumers in India are increasingly becoming more informed, connected, and demanding in the coming years. Policy does play a significant role, but given the uncertainties around the timelines for these changes, future ready power utilities will have to be prepared to undergo a paradigm shift, potentially revamping their business models completely to effectively ride these changes.

India – Power Surplus



FY 2018

India expected to be power surplus¹
Supply will outstrip the demand by **8%**

India is projected to become energy surplus in FY 2018, with energy supply exceeding the demand by more than 8%. In fact, as per Draft National Electricity Plan, with the current demand growth, if all the committed plants are constructed as planned, then there will be no need of additional capacity till 2022.

Utilities, will therefore, be dependent on consumers to fully realize their return on assets passing on bargaining power to the consumers.

GoI RE Targets -2022²



175 GW

Total RE Capacity

40 GW

Rooftop Solar

The advent of roof top solar would enable the consumers to produce their own power, thus reducing their dependence on power utilities. Ancillary services such as time of use tariff, demand response etc., will become further relevant and imperative.

- GoI targets and policies are easing the process of consumers moving out of the grid.
- Consumers will have the ability and flexibility to choose the time of power consumption.

Battery costs are going down³



77%

Fall in prices in last 6 years

The steep fall in prices of lithium ion batteries has made rooftop solar clubbed with battery storage increasingly cheaper, transforming them as serious competitors to utilities. The battery price is expected to fall below \$100/kWh as early as 2020⁴.

Thus, consumers' journey towards becoming prosumers is starting in earnest.

The era of Electric Vehicles is coming



6-7 Mn EVs

Target - 2020⁵

100% EV

New vehicle sales target - 2030⁶

The steep fall in battery cost is likely to make Electric Vehicles (EVs) much cheaper and a viable alternative to Internal Combustion Engine (ICE) vehicles. GoI's push to encourage adoption and manufacturing of EVs in the country is likely to play a role in boosting EV sales.

EVs would empower consumers to choose the time and place of consumption, thereby elevating the status of consumers to grid stabilizers.

Short term power trade is projected to double in India⁷

Short term power trade in India as % of total generation



Increasingly, with states becoming power surplus along with stranded coal fired power capacity of ~25GW⁸ in the country, the prices in the power exchange have plummeted leading to increase in share of power exchange in short term trades.

Power exchange provides large consumers (most profitable consumers for utilities) a choice and an economic reason to move out of the grid, thus introducing competition.



Content and Carriage separation

Increase in competition

The institutionalization of the impending separation of content and carriage would instill unprecedented competition in the Indian power sector.

Consumers would have the option to get supply from the retailer of their choice, inducing utilities to innovate to differentiate.



Smart Phone users are booming⁹

49%
Smart Phone adoption by 2020
~700 Mn
Smart Phone users 2020

India has the second biggest smart phone base in the world and is slated to have more than 700 million users by 2020.

With unprecedented access to real time information, consumers are likely to expect new ways of controlling and monitoring their power consumption and transparent communication from utilities.



The rise of social networks

Increase in consumer awareness



Spends on digital ads are projected to be over 46% of total media ad investment in 2020¹⁰, while mobile internet ad spend is expected to climb to 34.2% of total media ad investment. With the rise in subscribers of mobile broadband, social media has become a major mode for engagement.

Social media is increasing awareness levels of consumers and hence a major influencer of consumer preferences and brand image.



Rise of Connected Devices

20 billion¹¹
Connected devices across the world in 2020

India is projected to have 1.9 billion Internet of Things (IoT) units in 2020¹². With consumers becoming more and more connected and information becoming available on their fingertips, the digital era is already here.

Consumers make their purchase decisions based on hard facts (which can be accessed easily) and not merely based on better marketing.



Technological Revolution

Fintech, Digital banking

New revolutionary technologies are emerging with unprecedented speed and have the potential of changing the way the world works.

Technologies like Blockchain and Cryptocurrency are becoming easily accessible and affordable, thereby enabling consumers to transact easily with each other and paving the way for peer-to-peer sale of power.

A close observation shows that all these trends and disruptions are inevitably likely to result in providing consumers more choices of power procurement/consumption. Therefore, the consumer will be at the center of business models for future utilities.

What would consumers want from Utilities?

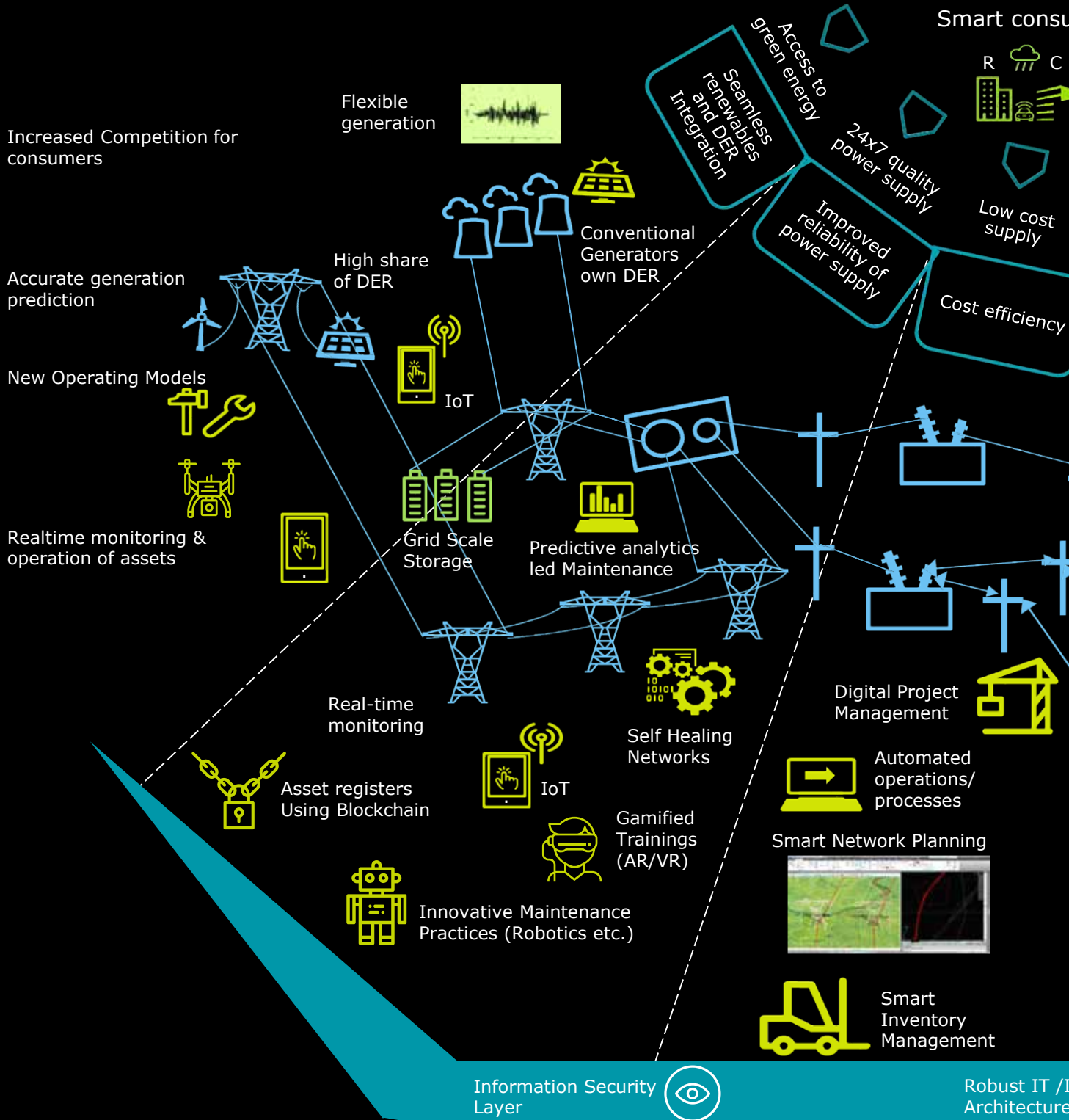
As consumers gain significant bargaining power in the coming years, they are likely to become the focal point of the power value chain. Utilities need to realign their future business models in order to meet the heightened consumer expectations, to remain relevant and to create value. It is therefore important to start by understanding the needs of the consumers of tomorrow.

24x7 quality power supply	As India moves to a power surplus position, consumers will increasingly aspire for reliable power supply. Given the consumer needs and increasing choices likely to be available in the future, the entire value chain needs to become reliable to create value and remain sustainable.
Low cost supply	With the growth in per capita power consumption, consumers – both industrial and domestic – demand for cheaper power. Consumers also expect multiple sources of power supply in order to reap the benefits of competition and surplus power situation.
Access to green energy	Climate conscious consumers of future will expect supply from green energy resources, thereby aiding in the growth of renewables.
Generate their own energy (Prosumers)	Consumers of tomorrow will also be the owners of Distributed Energy Resources (DER). As they become partners in business, consumers; expect utilities to create systems & processes to enable this transition.
Convenience and control	With the increase in smart phones and connected devices, consumers of the future would not only anticipate real-time information on services, outages, consumption etc., but also expect to remotely control how much and when they consume and have the convenience of switching to a seller mode through any of their assets (car batteries, rooftop solar etc.)
Value added services	As utilities mature and meet expectations along the services front, consumers would want utilities to help them with energy conservation, efficient electrical appliances, consumption analytics etc.

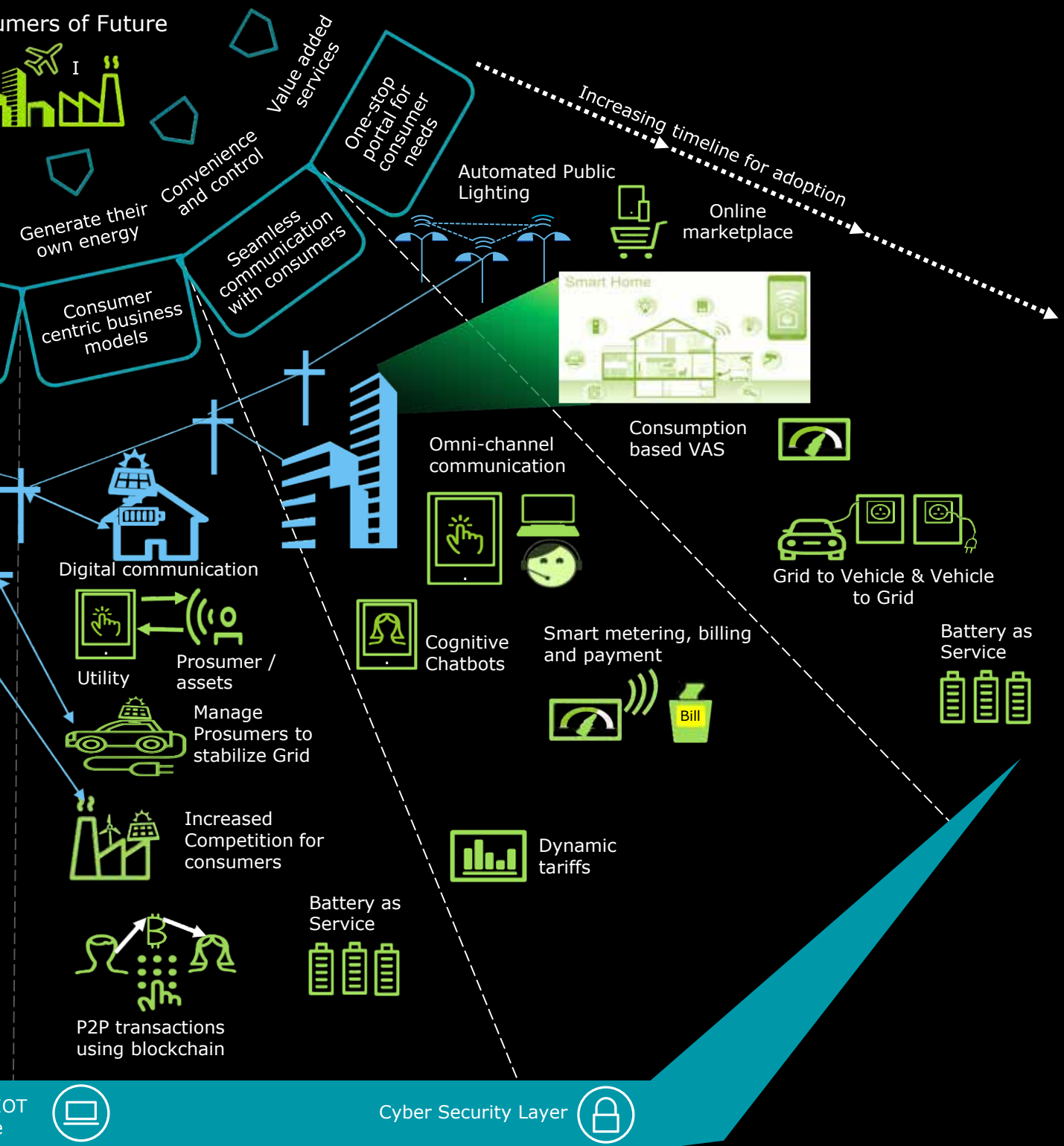
Digital technologies can play an enabling role and help power utilities address these needs of the consumers.



Digital can help utilities address evolving con



Consumer expectations



What do these expectations mean for utilities of the future?

In order to meet the expectations of consumers of the future, power utilities will have to adapt and make changes to the entire utility ecosystem, accordingly. Future utilities would have to [seamlessly manage the integration of DER into the grid](#), [provide reliable power supply of excellent quality](#), [be cost efficient themselves in order to provide cheap power supply](#), [regard consumers as partners in the journey](#), [provide impeccable customer service](#), and [be the one-stop portal for all energy needs of consumers](#).

01 Seamless renewables and DER integration

In the future, conventional generators will become flexible with ramp-up/down rates able to match the inherent variability of renewable sources like solar and wind. The use of digital technologies like [predictive analytics](#), [information rich dashboarding and visualizations for quick decision making](#) etc. would help counter the effects of flexibilization. Transmission and distribution utilities would concentrate on new technologies like [automated grid scale energy storage system](#) for countering the inherent variability of renewables. Powerful tools like [accurate weather models](#), [remote operation & monitoring technologies](#) and [big-data analytics](#) would come to the aid of these utilities to deal with the challenges of scheduling and ensuring adequate levels of power supply. The future energy retailers would employ innovative measures like [customized tariff options](#) to manage competition from the burgeoning DER market like rooftop solar, Electric Vehicles etc.

- [RWE Power, Germany](#)¹³ has installed a comprehensive process optimization solution to reduce its minimum load to less than 40% of the nominal output increasing the flexibility of the thermal plant.
- [PG&E, California, USA](#)¹⁴ is currently piloting a comprehensive Distributed Energy Resources Management System, that would allow the utility to monitor, optimize and dispatch DERs like behind the Meter storage, rooftop solar with smart inverters, EVs etc. to meet grid and market requirements.
- [Excel Energy, Colorado, USA](#)¹⁵ and National Center for Atmospheric research (NCAR) have developed a highly detailed wind energy forecasting system, which provides ~35% more accurate forecasts compared to previous forecasting methods.
- [AEP, USA](#)¹⁶ is piloting a solution to harness both active (distributed generation) and passive (load management) resources at the edge of the grid to act as virtual power plants or load centres as per the requirement of the grid to maintain stability.

02 Improved reliability of power supply

IoT combined with the [data-analytics](#) will provide operators with accurate assessment on asset health to enable [predictive analytics led maintenance](#). [Machine learning](#) would alert the operators and maintenance teams on any deviation of parameters. Maintenance crew would use [drones](#) to survey the area of fault and use [advanced image analytics](#) to identify the potential root causes of the fault. Once the work order is issued, the maintenance personnel would automatically be notified and be guided via [hand-held devices and 3-D plant imaging/GIS](#) to the fault location for carrying out maintenance activities. [Augmented Reality](#) would allow the assigned crew to accurately [check for isolations before beginning work](#), [access SOPs](#) for guidance, and [remotely connect to experts](#) as needed. The maintenance team would make use of [robotic assistants](#) to reach potentially dangerous areas for repairs. Thus, any fault in the system will be detected before it becomes a serious problem and be attended by the maintenance crew with a quick turnaround time while ensuring utmost safety at all times.

The future utilities would use digital tools, both on IT and OT fronts, to make evidence based decisions and maximize asset availability, minimize asset failure, identify faults and restore supply quickly to ensure reliability and quality of power supply.

- [Enel, Italy](#)¹⁷ uses [Boiler Climbing Robots](#) to simultaneously measure thickness of boiler tubes and clean off the dust and debris from the tube surface to help reduce boiler tube leakages and improve plant reliability in a [cost-effective and safe way](#).
- [A large manufacturer of industrial woodworking machines](#)¹⁸ uses [AR glasses](#) to guide customer's technicians remotely to help in effective maintenance apart from reducing the cost of service.
- [Kahramaa](#)¹⁹ Qatar's power distribution utility used [advanced asset health analytics software](#) and [asset management solution](#) to have real-time visibility over their asset's health. The solution has helped reduce substation faults by more than 50%.
- [FinGrid, Finland](#)²⁰ employed a [centralized asset management solution](#), [big data analytics](#) and [spatial analytics](#) platform to enable predictive maintenance, save costs and boost reliability. FinGrid achieved instant issue identification and faster fault analysis while also enabling smarter investment decisions.

03 Cost efficiency

The utilities of the future would have unprecedented competition, not only from other utilities but from the consumer as well and would need to improve their cost efficiencies. They would use digital tools like [historical data based optimum inventory forecasting](#), [smart sensors to auto-order spares from the most cost-optimal source](#) etc. to reduce their inventory management costs. The use of [intelligent devices like robots, drones](#) etc. will help reduce the operations and maintenance costs. Transmission and Distribution utilities, will use [accurate load forecasting](#) tools to enable [smart network planning](#) and smart investment decisions. Energy retailers would make use of [accurate electricity demand forecast models \(that account for DER, weather forecasts etc.\)](#) and [prices at various interfaces \(power exchange, generators etc.\)](#) to optimize their power procurement costs. In order to control project costs and construction timelines, tools like [cloud/mobile based project planning and monitoring](#), [drone / AR-VR assisted planning](#), [near field communication etc.](#), would be used extensively.

- **Drax Power Station, UK²¹** replaced its legacy stock management and work management applications with state-of-the-art applications which use [historical data of material consumption](#) and use them to [forecast the optimum inventory levels](#). It also enables [work order management](#), [asset risk assessment](#) and [human resource tracking](#) to optimally schedule essential work. Annual savings of up to £5 Million in cost savings were achieved due to this smart inventory management solution.
- **Utah Department of Transportation²²** used [Building Information Modelling tools](#) for a major road infrastructure project and achieved annual savings of \$200,000 in labour related costs which amounted to a [savings of 84% in labour cost](#).
- **Enel and E.On²³** two largest utilities of Europe recently traded energy through a [new market place called Enerchain using blockchain technology](#). This obviates the need of a central broker thereby reducing the cost of power procurement.

04 Consumer centric business models

The utilities of future will ensure that their business models revolve around the needs of the consumer such that the consumer would be a partner in their journey. DER owners, especially large industrial/ commercial consumers, will be both consumers and producers ([prosumers](#)).

For example, a consumer of the future can park their electric car in the office/residence parking lot and connect it to the charger which is in turn connected to the utility grid. The car would then be available for use for balancing the grid, i.e., to act as a power source during peak periods for some remuneration and as load centers during low load conditions for certain cost.

Future utilities would enable innovative business models like [peer-to-peer transaction of energy](#) using [blockchain](#). Digital technologies like [mobile applications](#), [real time price trackers](#), and [machine learning](#) (in terms of rates acceptable for consumers to act as power sources/ load centers) would be major enablers utilized by both, the utilities and the consumers. This could help solve the problem of [peak demand management for utilities](#) on one hand while [providing monetizing/cost reduction opportunities for the consumers](#) on the other. A similar scenario will be applicable for [Battery-as-a-Service](#) facilities, which could become an attractive business option for utilities with the advantage of scale kicking in.

Similarly, instead of providing last mile connectivity to remote villages, utilities will develop [cloud connected micro-grids](#) powered by DERs and storage devices for rural electrification solving the problem of electrification for consumers on one hand and negating the necessity for capital investments for utilities on the other.

- To leverage the booming rooftop solar market in Brooklyn (NY, USA), **LO3 Energy²⁴** in partnership with Siemens launched [Brooklyn Microgrid](#) which uses [blockchain technology](#) to enable [peer-to-peer energy sale](#).
- **United Energy²⁵** has developed a [community grid scale battery](#) in which the consumers can purchase share of the battery which would directly reduce their demand charge component of the bill while helping the utility shave off the peak demand.
- **Enel-SPA, Denmark & Nuvve, USA²⁶** are conducting pilot study which involves 10 Electric Vehicles that were used for balancing the grid when parked during the day. The fleet of EVs earned around \$1,350 over the period of a year performing the balancing act for the utility.



05 Seamless communication with consumers

With consumers becoming more and more connected, the mode of interaction with the consumers would also become prominently digital. Consumers would register their complaints through mobile phones/hand-held devices and the utilities would keep them abreast of the [complaint resolution status](#) through [interactive alerts/real time hotlinks](#).

Consumers will get consistent Omni Channel experience across all modes of interaction with the utility (website, mobile app, call center, walk-ins etc.), analytics will also help predict caller intent. Chatbots will provide 24x7 support to consumers on high volume low complexity queries.

With the deployment of [Smart Meters and smart payment solutions](#) the energy retailers would furnish electricity bills to consumers through various channels like email, text messages, online messaging services/social media (WhatsApp, Facebook etc.) with quick and secure payment services rendered through digital technologies like [blockchain and cryptocurrency](#).

Utilities will also use [social media mining](#) extensively in order to understand consumer needs and sentiments and try and identify measures for enhancing consumer engagement and in turn satisfaction.

- In order to revamp its existing online channel, [PNM, USA](#)²⁷ established a consistent user experience across multiple communication channels with the customers, provided extensive self-serve features and seamless integration with backend systems through implementation of various customer service software applications. The initiative led to increase in the online adoption, improvement in Net Promoter Score, and an optimized cost to serve.
- [Center Point Energy, USA](#)²⁸ is using [high speed predictive analytics](#) to transform its customer service strategy from reactive to proactive. The utility has designed a customer management system that provides personalized experience to consumers across communication channels which has helped in customer experience enhancement.
- [UK Power Systems](#)²⁹ extensively and successfully used Twitter to direct the traffic from Call Centers and improve call center response times when UK was struck by three major winter storms in quick succession in 2013.

06 One-stop portal for consumer needs

With access to energy consumption data of all its consumers, the energy retailer of the future would be able to leverage [big data analytics](#) and [machine learning](#) to understand each consumer and create customized solutions. For example, for a consumer with high energy consumption, the utility would communicate (with the customer's permission) the offer to sell smart devices that track dynamic tariff structure and modulate the consumption. Such a device would help the consumer optimize their consumption and reduce their bills.

The utilities of the future will make investments centered around the needs of the consumers be it in creating a widespread interoperable EV charging infrastructure, services like Battery-as-a-Service and actively participate in the connected home ecosystem. They would utilize the knowledge gained from [social media data-mining](#) and [digital surveys](#) to understand consumer preferences and make necessary investment accordingly.

Future utilities will also collaborate with vendors and get into new business models such as [automated public lighting, smart home management etc.](#)

- [Enel-Italy](#)³⁰ launched a new product called [e-Goodlife](#) that helps customers monitor their appliance level energy consumption remotely and enables remote operation of appliances.
- [SDG&E, PG&E, ConEdison, E.On etc.](#)³¹ maintain an online market place where consumers can procure energy efficient appliances for their homes. They can even apply for utility rebates through this channel.

07 Cyber security

With more and more systems getting integrated with the cloud, the day to day operations of power utilities as well as the communication with customers will increasingly become [more vulnerable to cyber attacks](#) and the [impact of each successful attack would also increase](#). For example, some group of individuals with exceptional computing skills and access can hack into the power grid of the future in order to [create a blackout in a certain area](#) thereby making it unsafe for the utilities and societies.

Hence, overarching everything, the utilities of the future will also pay extensive attention towards enhancing the cyber security and information security protocols and infrastructure in order to protect both their IT and OT environments.

- In 2015, more than 1.5 million homes in Ukraine were left without power when a hacker group attacked the Ukrainian Power grid with [BlackEnergy malware](#)³². A major [North American power generator](#)³³ wanted to protect its operations from such malwares and established a robust set of [cyber security protocols](#). The solution enabled intrusion detection and prevention thus securing its OT environment from exposure to security breaches.

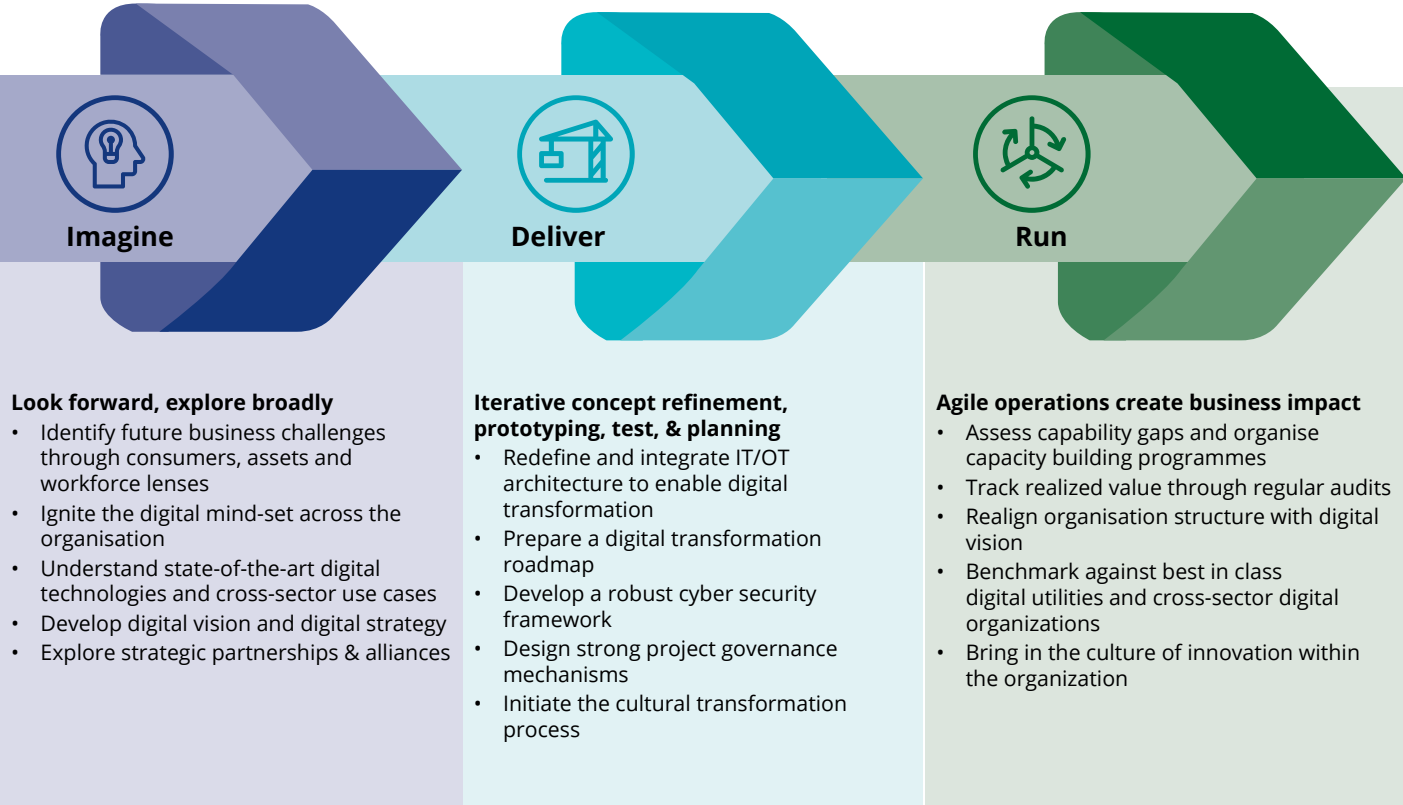
How can one transform their business models into digital utility of tomorrow?

The fourth Industrial revolution or Industry 4.0 is here, which is about leveraging the data generated by an industry and digital technologies to transform each and every aspect of the industry's value chain. While the Indian Generation utilities are largely **data ready (with DCS, historians etc.)**, Transmission & Distribution utilities are in the process of becoming data ready through investments in technologies like GIS, smart metering, OMS etc., **Power sector is an ideal candidate** for taking a leap ahead to undergo digital transformation. The success of power utilities would hinge on their ability to transform their business models and processes as well as their thought

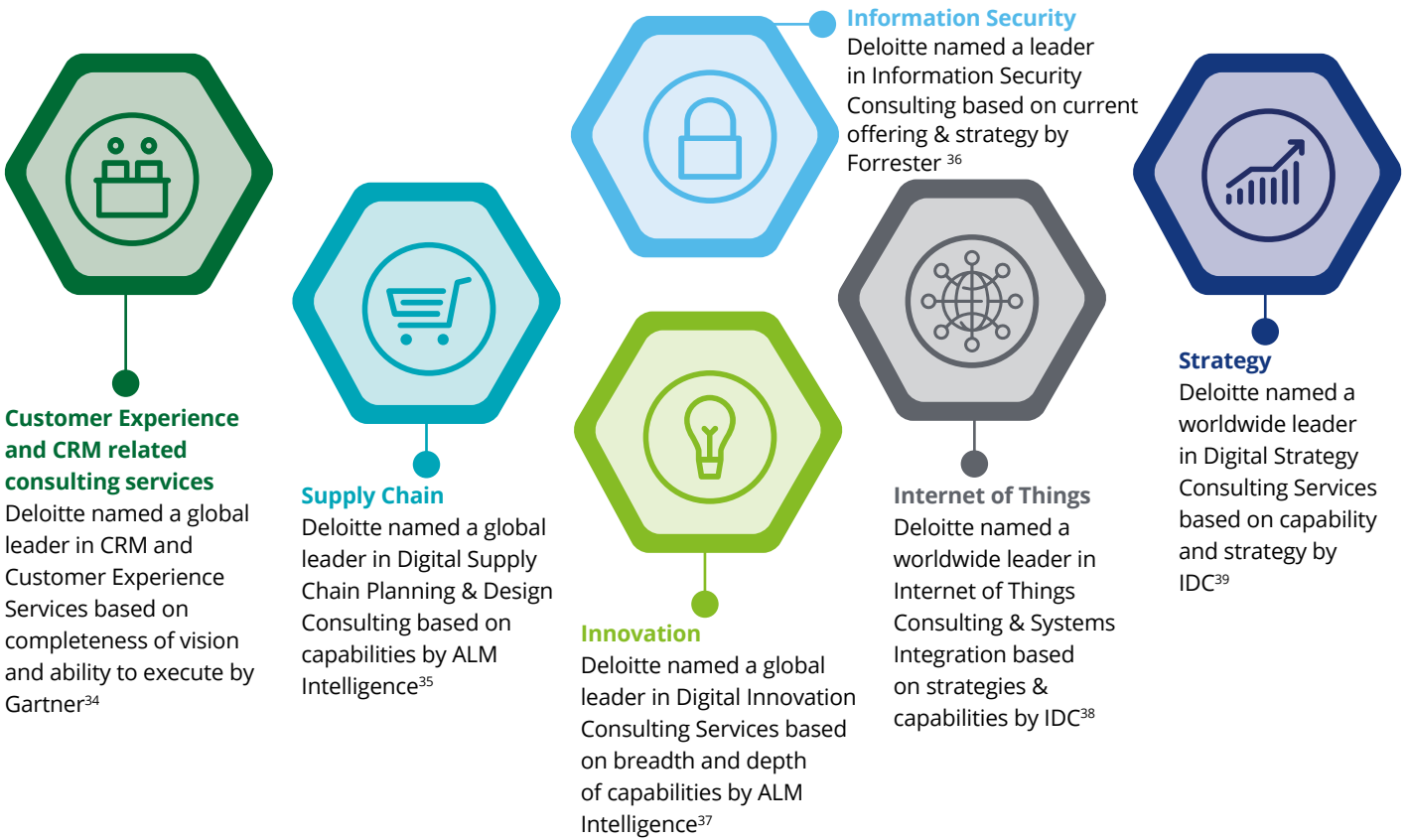
processes in order to cater to the changing needs of the future consumers. Digital utilities of the future need to have systems which are seamlessly integrated but loosely coupled making them responsive to the dynamic trends and business challenges of the future. Becoming a digital utility is neither an instantaneous job nor something that can be achieved in a few steps. Rather, it is a continuous process of making a series of business transformations aimed at digitization with **customer centricity** as a guiding philosophy.

To become a digital utility of the future, it would also be important to identify innovative business models that not

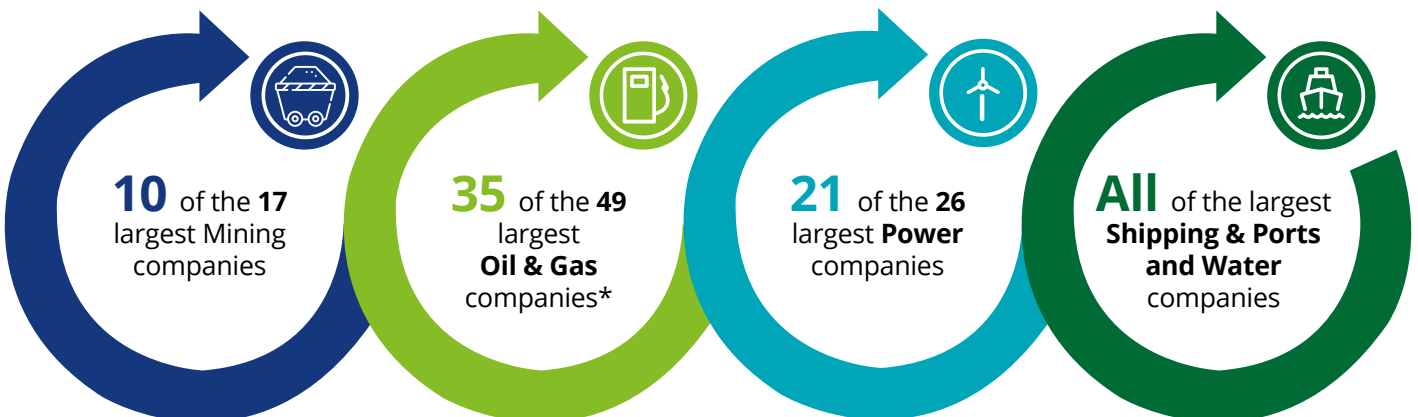
only provide new revenue streams, but also help in leveraging the digital ecosystem in creating value to the consumers, enterprise and all the other key stakeholders in the power value chain. Success will come from breaking the complexity into a sequence of manageable chunks and creating a robust implementation plan. Efficient program management, effective change management, and risk management also go a long way in enabling utilities transform to digital. Perhaps the most important aspect however, for any firm in this journey, would be to develop a digital mindset which would change the organizational culture to become a true utility of the future.



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#: For non-audit accounts, more than US\$500,000 in aggregate fees to Deloitte is required for a FG500 company to be counted as a Deloitte member firm client in this analysis

*: Plus a significant number of national oil companies

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