KPMG

Smart utility

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Utility of the future

The future of the power utility is set to change with a number of forces impacting the industry. These include:

1. The rising penetration of renewable energy in the grid. We expect it to reach 12.5 per cent[1] in energy terms by 2020 and could reach 50 per cent of daytime demand (MW) in certain states.
2. The rise of consumer choice enabled by open access for industrial customers and solar rooftop for residential.
3. The advent of digital technology, provides new avenues for utility to become more efficient, smart and enhance customer experience.
4. New developments in storage and eventually electric vehicles, which will change the power dynamics.

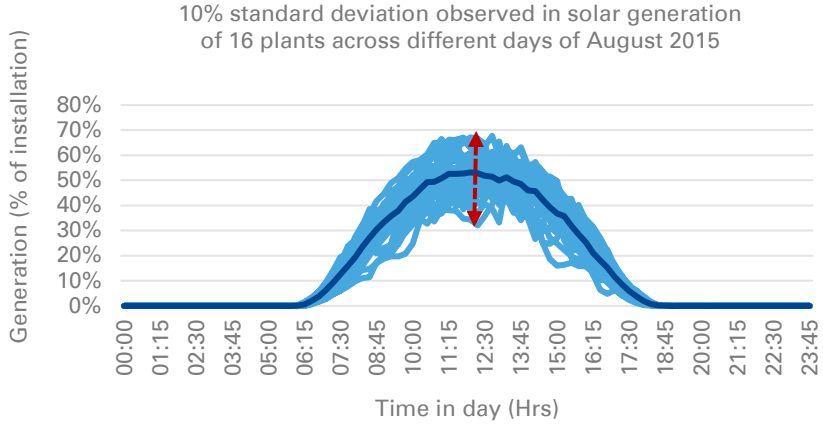
In light of these forces, utilities need to prepare for the change and embrace digital technologies to change the way they do business. This note highlights how some of the digital technologies can help utilities:

Integrating renewable energy

The rapid rise in Renewable Energy (RE) is expected to pose additional complexity to grid management. Two ways in which RE impacts the grid are i) Intermittency and ii) Variable generation profile/the duck curve impact.

First, intermittency in solar power generation occurs due to unpredictable weather conditions. While better forecasting tools can reduce the intermittency, our analysis suggests that the standard deviation of inter-day solar generation during noon could be around 10 per cent. This will have to be addressed through various mechanisms described below.

Figure 1. Observed deviation in solar generation



Source: APSLDC solar generation data, KPMG in India Analysis

40-50 percent
of day time demand (in MW) shall be met by solar power alone by 2019 in a southern state

For a solar rich state, the grid could be exposed to implied variation of up to 1,000 MW at 95 percentile confidence level (20% of 5,000 MW installed solar capacity) during noon

Potential approach

- Spinning reserves
- Demand response
- Energy storage tools
- Larger balancing areas

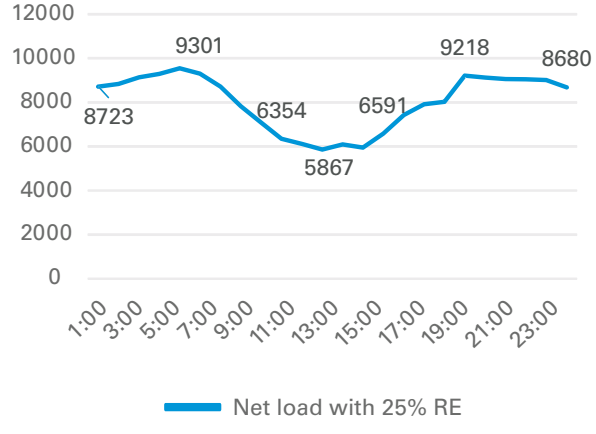
1. The Rising Sun III –Disruption on the horizon', Solar thought leadership publication -2015, KPMG in India

While maintaining spinning reserve capacity is an expensive option, demand response based solutions are expected to play an important role in contributing towards grid stability. Managing end-use consumption remotely based on grid signals will contribute towards grid stability besides benefiting consumers.

Next, the net load curve for the grid is expected to display the 'duck curve' characteristics that envisage huge ramping requirements in a relatively short timeframe. This effect becomes more prominent with rising solar power penetration.

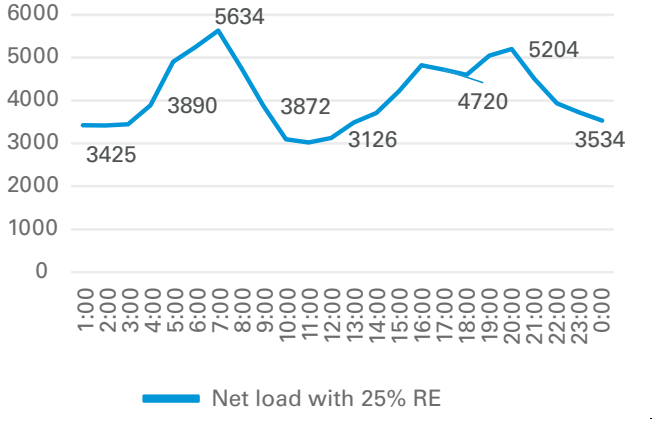
The graph below illustrates the net load curves (residual load curves after netting off solar and wind energy) developed for a southern state. The load curves demonstrate the duck curve effect with varying ramping requirements across different seasons.

Figure 2. Net load curve - March 2019



Source: AP State Load Dispatch Centre (SLDC), KPMG in India's analysis, 2016

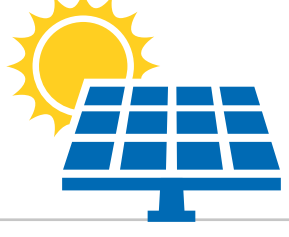
Figure 3. Net load curve - July 2019



Source: AP State Load Dispatch Centre (SLDC), KPMG in India's analysis, 2016

India's agriculture sector consumes large amounts of electricity (around 20 per cent) that is currently supplied in a manner that balances demand with availability. Remote monitoring of agricultural feeders that can be switched on and off remotely can help provide flexibility to integrate more solar power into the grid and partially mitigate the duck curve effects. The other ways of handling this include bringing flexibility in generation plants to enable faster ramp rates and reduced technical minimum thresholds of generation.

Utilities should start investing in digital infrastructure that can help monitor and control all their agricultural feeders remotely, and also employ tools to make generation plants more flexible.



Use of data analytics and Internet of Things (IoT) for improving quality of power supply

The quality of power supply in Indian utilities is way below international standards, which impacts the competitiveness of the industry and imposes coping costs among all consumers. Digital technologies can help Indian utilities to quickly overcome these deficiencies in a cost-effective manner. For example, leveraging data from the existing network in a more dynamic manner using digital tools can help utilities plan their network optimally.

Automated information capture for detection and fault identification through a mobile or web interface will help monitor network performance in real-time. This will enable timely interventions and communication with consumers and bring more visibility and control across the organisation. With better inventory management and improved asset maintenance, digital technologies can help reduce cost of the utilities as well.

Country/DISCOM	Customer outage minutes per year
U.S.A.	228
Germany	34
UK	80
Italy	100
India	**12,400**

The economic cost of interruptions is high and Indian utilities have to start leveraging digital technologies to improve network reliability.

Already, many global utilities have adopted innovative sensor-based digital tools in areas such as predictive maintenance, condition-based monitoring, process re-engineering etc. to reduce network interruptions and lower costs.

Source: 'Germany's electricity grid stable amid energy transition' - Factsheet, 20 October 2016 | Sören Amelang, Jakob Schlandt. URJA app, KPMG in India's analysis, 2016

Case study

Using machine learning to predict feeder section failure

A top European utility deployed a predictive maintenance tool to predict faults on feeders. This tool integrates data from various sources such as SCADA, maintenance work orders, historical equipment failures, lightning, terrain, vegetation and weather, and leverages more than 750 analytics to update the asset health score in real-time as data is received. The tool then uses a machine learning model to predict the probability of feeder faults and pinpoint their locations with increasing precision over time. This has helped improve the reliability of the grid.

Source: Enel.com, November 11, 2015, 'Enel Increasingly Digital and Smart'. http://c3iot.com/enel-and-c3-energys-machine-learning-based-predictive-maintenance/

While Indian power utilities have initiated steps to build the necessary digital infrastructure to monitor their networks, their adaptability and usage needs to be fast tracked.

New consumer services and revenue streams

Power consumption is undergoing transformation with new emerging technologies such as distributed generation, storage, electric vehicle charging and smart home applications becoming mainstream. Globally, utilities have introduced innovative value-added services for consumers, including energy management products and services, home automation services and introducing the utility store concept. Indian power utilities also need to explore the introduction of new consumer services that enhance customer experience and help realise more revenue.

Case study

New revenue streams

A European utility - Personalised energy savings toolkit

Provide personalised advice and products to help customers control energy use and reduce their energy bill using data analytics and behavioural science. The savings toolkit helps customers understand how they use energy and when they use it the most. It provides easy to read charts that detail how energy use changes on a month-by-month basis and how energy is currently used in the home, divided between heating, lighting, hot water, appliances and other uses.

A U.S.A based utility - Concept of utility stores

- Market place for appliances such as smart thermostats, energy-efficient washers, refrigerators, water heaters, pumps, etc.
- E-commerce platform for appliances such as LED bulbs and energy efficient equipment such as water heaters.

Source: 'E.ON strengthens its Digital Expertise', 07/11/16. http://www.eon.com/en/media/news/press-releases/2016/7/11/eon-strengthens-its-digital-expertise.html ; https://marketplace.sdge.com/ ; https://www.duke-energy.com/business-savings-store/

In sum, it is an opportune time for the utilities to consider leveraging digital technologies to help become more agile, smart, and improve customer experience.

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