

SMART METERS : IMPROVING THE HEALTH OF DISCOMS

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ABSTRACT

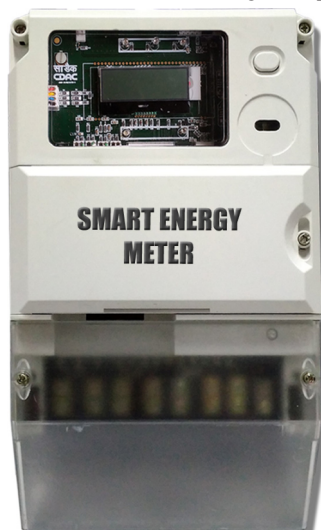
Metering has been the Achilles heel of the Indian electricity distribution sector since many years. Despite recent releases of the national smart meter standard, guidelines on smart metering by the Government of India and other policy level initiatives, Indian distribution companies were not keen to implement smart metering owing to high capital expenditure, leading to fragmented deployment in small numbers. The Indian smart metering journey has seen many ground-breaking initiatives such as release of national standards for smart meters, functional requirements of Advanced Metering requirements of Advanced Metering Infrastructure (AMI) by Central Electricity Authority (CEA), announcement by Ministry of Power (MoP) to rollout 250 million smart meters by 2021 etc. While these initiatives provide a strong foundation for implementing smart metering, there are a number of other activities that still need to be taken up in order activities that still need to be taken up in order to unlock full potential. This paper elucidates such initiatives at a financial, regulatory and DISCOM level. Furthermore, key value added services have been mentioned which can be provided to customers by using smart metering. Post implementation of smart metering, significant benefits were observed by the distribution company in areas of increased revenue, reduced operational efforts and acceptance by regulator. This paper also explains case study in Uttar Pradesh, India, that observed these benefits of smart metering.

KEYWORDS :**BENEFITS OF SMART METERING**

Smart metering benefits can be grouped into three major categories, namely, 'Financial', 'Operational' and 'Regulatory & Societal'. Societal benefits include benefit to consumers and society, as a whole. Both quantitative and qualitative benefits have been explained in this paper based on the data of NDMC, KESCO (Kanpur) and PVVNL (Meerut). DISCOMS are using Bureau of Indian Standards (BIS) certified smart meters (compliant with IS 16444) and a smart metering solution hosted on cloud environment that is in accordance with guidelines issued by the Central Electricity Authority, Government of India [1]. Furthermore, the smart metering solution is in accordance with recent announcement by Ministry of Power to install smart pre-paid meters for all consumers in India.

2.1 Increase in Thru Rate

Thru rate, defined as ratio of billed amount and energy procured provides an overall impact of various billing efficiency and power quality initiatives undertaken by the DISCOM. Post installation of smart meters in KESCO, it was observed that the Thru Rate increased by 8.43% (avg. of comparison between January - July of 2018 and 2019) thereby providing substantial financial and regulatory benefits.

**2.2 Reduction in Exceptional Billing**

Prior to smart meter installation, UP DISCOM conducted exceptional I provisional billing of those consumers whose meter couldn't be read.

Post installation of smart meters in UP DISCOM, it was observed that number of exceptional billing cases drastically reduced by 73.21% (avg. of comparison between January - July of 2018 and 2019) thereby providing financial benefits to DISCOM. As an example, in July 2018, the number of exceptional billing cases was 464, while in July 2019, this number was reduced to 2 (a reduction of 99.57%).

2.3 Reduction in Bill Correction

Prior to smart meter installation, KESCO engaged in cumbersome bill correction processes due to inaccurate billing.

Post installation of smart meters in KESCO, it was observed that number of bill correction cases drastically reduced by 65.46% (avg. of comparison between January - July of 2018 and 2019) thereby providing financial and societal benefits to DISCOM. As an example, in July 2018, the number of bill correction cases was 214, while in July 2019, this number was reduced to 7 (a reduction of 96.73%).

2.4 Reduction in Due Date Deviation

Prior to smart meter installation, as meter reading was done manually, it would take weeks for meter reading and subsequent bill generation to be complete, in turn delaying the collection date from consumer. This would lead to a negative impact to the cash flow of the DISCOM.

Post installation of smart meters in KESCO, it was observed that number of due date deviation cases drastically reduced by 34.19% (avg. of comparison between January - July of 2018 and 2019) thereby improving the cash flow of KESCO. As an example, in July 2018, the number of due date deviation cases was 287, while in July 2019, this number was reduced to 44 (a reduction of 84.67%).

2.5 Ability to Conduct Detailed Cost-Benefit Analysis

Prior to smart meter installation, an analysis of energy consumption of consumers and energy Gain / Loss percentage as per Time of Use (ToU) tariff and tariff slab was not possible.

Post installation of smart meters in UP DISCOM, it is possible to conduct a cost benefit analysis to ascertain the Gain / Loss percentage in each tariff slab, thereby allowing the regulator to adjust the tariff of each slab accordingly . For example, in the 0-100 units slab and 0-1000 units slab, the Gain / Loss is -36.17% and 49.3%, respectively, thereby allowing the regulator to perform tariff adjustment, if needed.

Similarly, it is possible to conduct a cost benefit analysis to ascertain the profit to UP DISCOM in each ToU . For example, UP DISCOM made a profit of 14.99% in T3 ToU zone, whereas, it made a lesser profit of 10.07% in T1 ToU Zone. This vital information can be used by the regulator to adjust the tariff of each ToU as per requirement.

2.6 Reduction in AT&C Losses

Due to accurate, complete and timely billing, identification of theft and ability to penalise consumers in near-real time, the billing efficiency of DISCOMs shall increase. Global implementations of smart metering also suggest that via the enhanced service offered by smart metering, consumer satisfaction levels increase gradually, leading to improved collection efficiency. As a result, the AT&C losses tend to reduce substantially over a period of time which permit tariff-neutral distribution system upgrade.

2.7 Reduction in Peak Power Purchases

As smart metering provides granular (15/30/60 minute) load profile readings, energy forecasting can be done accurately. This provides substantial financial benefits to DISCOMs via reduced power purchase cost, while also improving (or reducing) the revenue requirement presented to the regulator.

2.8 Reduction in Manual Meter Reading, Data Entry and Meter Disconnection/Reconnection Cost

A major operational benefit of smart meters is the ability to remotely obtain meter readings from the field and storing in DISCOM databases, thereby improving the need to hire / depute meter readers and data entry operators. Furthermore, using smart metering, DISCOM can remotely disconnect and reconnect the electricity supply to the consumer. These operational benefits also lead to financial savings to the DISCOM.

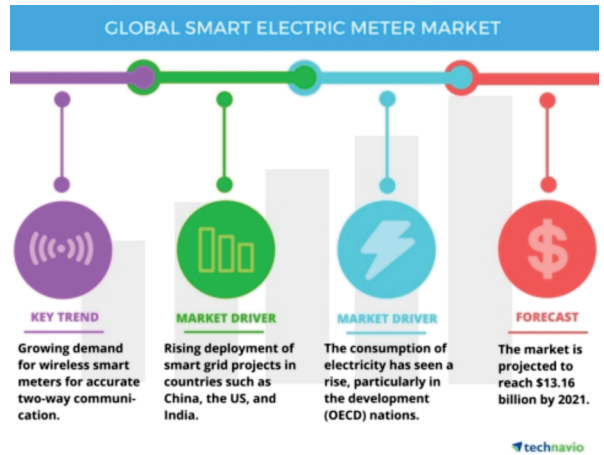
2.9 Faster Detection of Dead Meters

As smart meters have innovative features such as last gasp notifications, DISCOM will detect dead meters faster via the notification received from meters, rather than conducting field visits. This will provide financial benefit to DISCOM resulting from increased power being sold to consumer.

2.10 Other Benefits of Smart Metering

In addition, smart metering has other benefits, including, but not limited to the following:

- a) Ability to conduct power quality analysis in near-real time
- b) Improved reliability indices such as CAIDI, CAIFI, SAIDI, SAIFI etc.
- c) Reduced load on consumer care centers as defective / dead meters can be identified faster
- d) Better cash flows of generation companies due to better financial health of DISCOMs
- e) Ability for consumers to monitor and manage electricity consumption and save money
- f) Satisfied consumers due to error-free bills
- g) Reduction in carbon footprint via reduced patrolling for meter reading, disconnection/reconnection, outage detection etc.



3. FUNDING OF SMART METERING PROJECTS

The revenue spend on smart metering in next three years in Indian power sector is expected to be INR 1.4 Lakh Cr. Limited availability of funds has been the Achilles Heel of smart metering in India. To alleviate this issue, DISCOMs may consider a model in which a financial institution purchases smart meters and leases to the Executing Agency (such as EESL) or DISCOM against a monthly rent (which would include an agreeable return on investment). Other components of smart metering could be procured using any of the innovative business models mentioned in the subsequent section. This would be win-win situation for both, DISCOMs and the financial institution.

4. DISCOMs Business Processes Change

With DISCOMs planning to deploy smart metering, the existing business processes would have to be changed. DISCOM personnel would have to adopt new processes for activities such as meter reading, re-connection, disconnection, outage management etc. Some of the key business processes have been listed below:

- a) DISCOM enrolls customers in a smart metering- related service or product
- b) DISCOM updates customers' account information to maintain the accuracy of records
- c) DISCOM provides consumption and tariff data to customers via mobile app and customer portal
- d) DISCOM captures consumption data through remote meter reading
- e) DISCOM carries out remote reconnection and disconnection of meters
- f) Meters transmit events data to DISCOM data center
- g) DISCOM takes appropriate action on events gathered from meter
- h) DISCOM reduces outage duration by analysing test gasp information from meters
- I) DISCOM generates bills to be issued to customers
- j) DISCOM implements smart prepaid metering after customer opts for prepaid billing
- k) DISCOM upgrades firmware of meter remotely
- l) DISCOM updates ToU configuration in meters remotely
- m) DISCOM synchronises meter clock remotely
- n) DISCOM conducts reactive and proactive maintenance of the smart metering system
- o) DISCOM activates disaster recovery procedures to maintain business continuity in case of system failure
- p) DISCOM implements net metering and gross metering

5. Value Added Services that DISCOMs can Offer with Smart Metering

Smart meters can provide DISCOMs with an opportunity to provide a number of value added services to its customers. Key services and their impact have been listed in Table-2.

Table-1: Key Value Added Services with smart metering

S. No.	Use Case	Impact
1.	Load balancing	Network optimization
2.	Consumption analysis	Reduction in DISCOM power purchase cost
3.	Outage management	DISCOM revenue increase and better customer service
4.	Power quality services (surge protection)	Enhanced quality of service
5.	Demand response	Financial benefits (to customer & DISCOM)
6.	Crash billing of customers	Increase working capital DISCOM
7.	Energy efficiency tips	Better customer service
8.	Analysis of reverse reading cases	DISCOM revenue increase
9.	Customer category mismatch	DISCOM revenue increase
10.	Rooftop solar (net metering)	Financial benefit to customer

Some of these services might also be possible without smart metering. However, with the enhanced service (from additional smart metering features), customers will be more inclined to participate in the value added services offered by DISCOMs.

6. Customer Awareness

The most important link in unlocking full potential of smart metering is the end- customer. Customer will utilize inherent features of smart metering and enroll into value added services only if he/she is aware of the actual benefits and how they would create an impact. To start with, it is critical to communicate the benefits of smart metering to the customer using customer portal and mobile application. Additionally, means such as pamphlets, Automatic Voice Response System, social media, email, whatsapp, advertisement in newspaper/magazine, nukkad natak etc. shall be used for enhancing customer awareness.

7. SMART METERING AS BUILDING BLOCK FOR SMART GRID AND SMART CITY

Smart meters are a foundation for a smart grid as they provide real-time information at the level of end- customers. A smart grid will benefit from this granular visibility and will lead to more efficient grid operation. When smart metering system will be integrated with the Advance Distribution Management System (ADMS), Distributed Energy Resource Management System (DERMS), Outage Management System (OMS), Distribution Transformer Monitoring Unit (DTMU), Electric Vehicle Energy Management System (EVEMS) etc. DISCOMs will be able to maintain the stability of the grid thereby providing better service to consumers.

As India has already ventured into smart cities, the communication network laid down for smart metering can be leveraged to provide data from water meters and gas meters to respective water distribution and gas distribution departments, thereby using smart meters as anchor infrastructure for smart cities. Furthermore, with additional home and building automation tools, smart meters can provide the ability to manage and control appliances at homes and offices.

8. GPRS FOR SMART METERING

While many people believed that GPRS is not suitable for smart metering, EESL has deployed over 5, 00,000 smart meters in India using 3G technology (with fall back to 2G technology). Fig-7 depicts the data usage for the EESL smart metering project and its comparison with 2G and PSTN technology.

For about 5, 00,000 meters, an average of 60- 70GB data usage happens in a day. It can be calculated that, practically 7kB is required per meter per hour to pull the monthly billing data which can be managed even with 2G data rate (40 kbps) as well. From this calculation, it can be ascertained that 3G provides more than sufficient bandwidth for smart metering data communication.

9. SUMMARY OF SMART METER BENEFITS

As smart meters offer benefits in diverse areas, a summary of these benefits is presented in Table-2 below. In this table, benefits have been bifurcated as financial benefit to DISCOM, operational benefit to DISCOM and regulatory and societal impact.

Table -2 Summary of Benefits

S. No.	Benefit	Financial benefit to DISCOM	Operational benefit to DISCOM	Regulatory and social benefit to DISCOM
1	Increase in monthly consumption and fixed charge	√	X	X
2	Increase in thru rate	√	X	√
3	Reduction in Exceptional Billing	√	X	X
4	Reduction in Bill Correction	√	X	√
5	Reduction in Due Date Deviation	√	X	X
6	Ability to Conduct Detailed Cost-Benefit Analysis	√	√	√
7	Reduction in AT&C Losses	√	X	√
8	Reduction in Peak Power Purchases	√	X	√
9	Reduction in Manual Meter Reading, Data Entry and Meter Disconnection/Reconnection Cost	√	√	X
10	Faster Detection of Dead Meters	√	√	√

10. CONCLUSION

The paper explained practical benefits of smart metering from operational, financial, regulatory and social point of view both quantitative and qualitative using some data from DISCOMs. Some key benefits are Reduction in Exceptional Billing, Reduction in Bill Correction, Reduction in Due Date Deviation, Ability to Conduct Detailed Cost- Benefit Analysis, Reduction in AT&C Losses, Reduction in Manual Meter Reading, Data Entry and Meter Disconnection/Reconnection Cost etc. While these benefits are direct, some indirect benefits also present and hence enhanced the acceptability of regulator. All Discoms accepting the roll outs of smart metering and the convergence will be seen in coming years. Smart metering has evolved drastically in past few years and most of the Indian discoms started deployment of smart meters. However many initiative still needs to be taken by regulators , discoms and government. Smart meter can also be used as foundation for smart grid and smart city.