PART B: Benefits of AMI to Different Stakeholders

Session Content

- Distribution Utility
- Transmission and Generation Utilities
- Customers
- Society

Speaker:

Reji Kumaar Pillai

President - India Smart Grid Forum,

Chairman – Global Smart Energy Federation

Benefits to Distribution Utility (1/5)

Sl No	Smart Metering Benefits to Distribution Utility	Financial Impact	Dependency on COMMs
1	**Reduced metering reading and data entry cost** Without smart meters, DISCOMs must send personnel to customer premises to manually read the meter. Implementation of AMI enables remote meter reading both regularly and on-demand. Data entry and processing is performed automatically. Overall, AMI should deliver greater convenience at reduced cost relative to traditional meter reading	**Medium**	**Low**
2	**Reduction in time taken for meter reading and bill generation as well as reduction in errors** There are always chances of human errors when meters are read manually or even via automatic hand-held devices. In addition, the process is time consuming. By delivering meter data automatically over communication networks, AMI eliminates human error from the meter reading process as well as make the entire process faster	**Medium**	**Medium**
3	**Reduction in cost of disconnection and re-connection** as it can be managed through remote operation of the AMI system	**Medium**	**Medium**

Benefits to Distribution Utility (2/5)

Sl No.	Smart Metering Benefits to Distribution Utility	Financial Impact	Dependency on COMMs
4	**Faster detection of dead meters** and hence enhanced revenue protection	**High**	**Medium**
5	**Real time energy auditing and accurate energy accounting from time-stamped meter data**	**High**	**Low**
6	**Enhanced Revenue per Month** Large share of meters existing in DISCOMs are old and hence the readings are not very reliable. With new smart meters, the accurate energy consumption can be captured which will enhance the monthly revenue considerably. It is expected that the monthly payment to AMI Service Provider (AMISP) can be met from the increased revenue. This has been the experience in DISCOMs where AMI has been implemented (eg: Mysore, Indore, Gujarat, NDMC, Bihar). With 15% of capex as grant from GoI, and the rest 85% paid monthly over 10 years from increased revenue on a monthly basis is a very attractive option for DISCOMs	**High**	**Medium**
7	**Reduction in Aggregate Technical & Commercial (AT&C) losses** AMI can remotely detect meter tampering and enable real time energy accounting. This reduces theft through by-passing the meter, thereby substantially reducing aggregate technical and commercial (AT&C) losses. AMI will also streamline the billing, or meter-to-cash, process considerably by reducing the human errors in meter reading and billing.	**High**	**High**

Benefits to Distribution Utility (3/5)

Sl No.	Smart Metering Benefits to Distribution Utility	Financial Impact	Dependency on COMMs
8	**Enabling faster outage detection and service restoration after faults** Traditionally utilities know about an outage when they receive complaints from affected customers. Service restoration requires utility crews to identify the area and rectify the fault - a time consuming and expensive process. The Bureau of Indian Standards requires all smart meters to be capable of sending 'last gasp' and 'first breath' messages, which informs the utilities when power has failed or resumed. This will reduce outage restoration times leading to financial savings and improved customer satisfaction	**High**	**High**
9	**Better load research and demand forecasting from AMI data can reduce power purchase cost** With meter data time stamped at 15-minute intervals, AMI enables near real-time estimation of customer demand and understand customer's power consumption in granular detail. This improves DISCOM's load forecasting and enhances the ability to procure the right volumes of power. Utility can also implement time-of-use (ToU) tariffs for different categories of customers and encourage load shifting with demand response programs. These measures could reduce peak load and hence reduce purchase of expensive power during the peak hours	**Medium**	**Low**

Benefits to Distribution Utility (4/5)

Sl No.	Smart Metering Benefits to Distribution Utility	Financial Impact	Dependency on COMMs
10	**Power quality measurement and management** Smart meters are capable of measuring specific aspects in near real-time, such as power factor, over or under voltage, and over current. This helps DISCOM to enhance system power quality in conjunction with power quality data from other sources. Improved power quality also leads to lower power losses. Also, avoided costs associated with investigation of voltage complaints	**High**	**High**
11	**Asset optimization** AMI data supports granular monitoring of power flows on the distribution network which can help DISCOM identify segments of over- and under-loading. This is valuable information for system planning and optimizing network upgrades. AMI data can also help balance load, which reduces power losses. Better visibility of loading on the power system will help faster/delayed capacity enhancement and prevention of failure/under-utilization of equipment. Furthermore, network monitoring can decrease equipment failure rate by identifying phase imbalances and over loading in advance which can be corrected.	**High**	**High**
12	**l. Ability to operate in pre-paid and post-paid modes**	**Medium**	**High**

Benefits to Distribution Utility (5/5)

Sl No.	Smart Metering Benefits to Distribution Utility	Financial Impact	Dependency on COMMs
13	**Remote operations** Smart meters typically include remote switching, which allows utilities to remotely disconnect or reconnect where necessary, such as when load is exceeded, for predetermined events, in the case of non-payment, or when a customer move. Additionally, Utility can monitor the health of the meter and dispatch maintenance only where necessary	**Medium**	**Medium**
14	**Improvement in reliability indices and its accurate measurement** Enhanced monitoring of the distribution network operations would significantly improve the reliability indices like CAIDI/CAIFI, SAIDI/SAIFI as well as help measure these indices accurately.	**Medium**	**Low**
15	**Reduced load on call centres, customer care centres and billing centres**	**Low**	**Low**
16	**Smart meters act as feedback points** for understanding the behavioural interpretations of energy demand as consumption which can be modified	**Low**	**Low**

Benefits to TRANSMISSION and GENERATION Utilities

Sl No.	Smart Metering Benefits to TRANSCOs and GENCOs	Financial Impact	Dependency on COMMs
1	Deferred or avoided transmission capacity investments	**High**	**Medium**
2	Deferred or avoided generation capacity investments on peak load plants and spinning reserves	**High**	**Medium**

Benefits to CUSTOMERS

Sl No.	Smart Metering Benefits to CUSTOMERS	Financial Impact	Dependency on COMMs
1	Error-free bills and no need for visiting billing centers	**Medium**	**Low**
2	Innovative tariff schemes	**Medium**	**Medium**
3	Faster restoration in case of outages	**High**	**High**
4	Remote control of loads in customer premises	**High**	**High**
5	Ability to remotely manage and control appliances	**Medium**	**Medium**
6	Potential to save money	**Medium**	**Medium**

Benefits to the SOCIETY

Sl No.	Smart Metering Benefits to SOCIETY	Financial Impact	Dependency on COMMs
1	Reduction in carbon footprint	**Medium**	**Medium**
2	Better customer engagement on energy conservation and demand side management initiatives	**Medium**	**Medium**
3	Enhanced customer satisfaction	**Medium**	**Medium**
4	Energy efficiency and energy conservation	**Medium**	**Medium**

PART C: AMI 2.0

Session Content

- Smart Meter Operations Centre (SMOC)
- Advanced Applications and Analytics
- Smart City Applications
- Next Generation Metering – Distributed Intelligence

Speaker:

Reji Kumaar Pillai

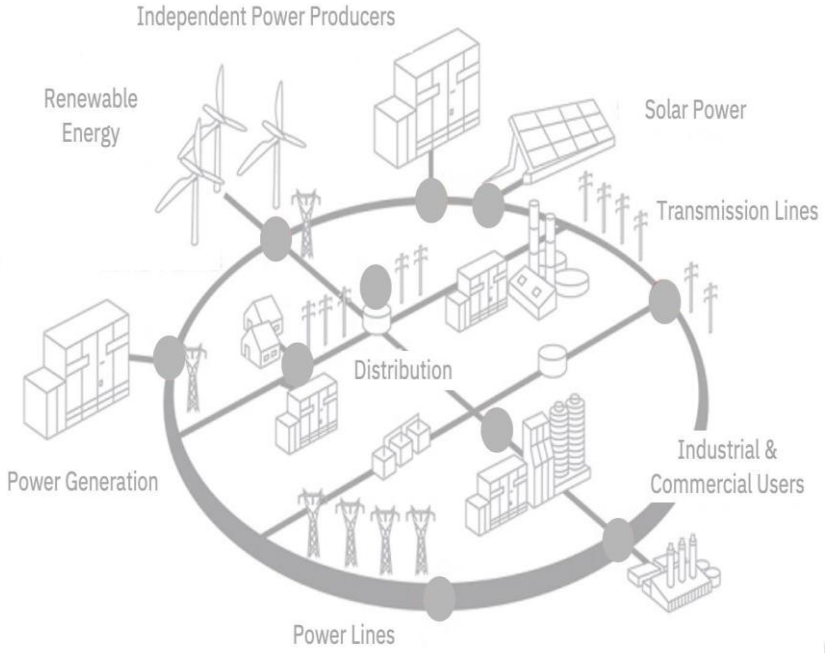
President - India Smart Grid Forum,

Chairman – Global Smart Energy Federation

AMI 2.0 – Introduction

AMI 1.0: Focus was on core metering, meter data management

AMI 2.0: Focus is on big data analytics for sophisticated use cases



AMI 2.0 Features (1/2)

- **Advanced Analytics:** The time stamped electricity consumption data captured from smart meters can be analyzed with the help of Artificial Intelligent (AI) and Machine Learning (ML) tools to understand the power flows in real time and identify overloaded/stressed assets; locate which transformers to be replaced with higher capacity ones; which transformers have phase imbalance issues that must be corrected; detect meter tampers and irregular usage patterns; detect theft/unmetered loads; improve connectivity models; and conduct reliability analysis, storm analysis and momentary analysis.
- **Grid Management - Distribution Automation and Voltage Management:** Modern AMI networks can support many more devices than smart meters. Devices that add intelligence to the distribution grid are now common place within an AMI network. These include Reclosers and Automated Switches; Capacitors; Line Sensors and Fault Passage Indicators (FPIs); and Smart Inverters.
- **Transformer Monitoring:** The AMI system can be leveraged to implement transformer monitoring systems and get the near-real-time data of transformer performance to the utility control room.
- **Demand Response/Demand Side Management:** Smart meters often include a home automation functionality through wireless communication (ZigBee, Wi-Fi or similar technologies). These radios help enable demand response (DR) programs by creating connections to in-premise displays, smart thermostats and other smart appliances. When paired with time of use (ToU) rates, the smart devices may be programmed to react to price signals or curtailments to help manage energy during peak periods.

AMI 2.0 Features (2/2)

- **Smart EV Charging:** AMI system could support smart charging of EVs (V1G) which can control the power flow to the chargers during peak-hours.
- **Distributed Generation:** Modern smart meters are capable of recording data on several channels. This functionality is used to support distributed generation to record several values simultaneously, including Real Power, Reactive Power; Power Received; Power Delivered etc.
- **Smart Street Lights:** Many AMI systems now offer Smart Lighting Control solutions. Key system functionalities include:
    - Remote control and monitoring of lights
    - Improved energy efficiency, via LED lights
    - Individual metrology on each fixture
    - More timely and efficient repair of lights
    - Ability to brighten or flash lights in support of public safety
    - Software allows graphical viewing and grouping of lights, measuring, and reporting of power consumption, fixture failures and alarms, alarm mapping, on/off scheduling
    - Ability to integrate Air Quality Monitoring Sensors

Smart City Applications

The modern AMI networks can support a host of smart city applications at marginal cost to the benefit of infrastructure services providers and customers. Some of the examples are:

- Utility integration and combined billing system for electricity, water, gas, house tax and other municipal charges
- Smart buildings – grid integrated buildings
- Smart waste management
- Water management including leakage detection and reporting
- Assets tracking
- Smart EV charging
- Smart traffic lights, smart roads, and vehicle detection
- Smart parking
- Video surveillance and remote security monitoring
- Emergency response and mass notifications

Smart Meter Operations Center (SMOC)

- Field deployment of smart meters is one the biggest challenges that Utilities face in their smart metering programmes. A dedicated Smart Meter Operations Centre (SMOC) can overcome the obstacles and significantly reduce rollout risk
- SMOC will help in taking accountability for the overall field deployment and coordination across all business functions. The right approach to field deployment can result in a saving of 20-30% in operational costs of smart meter rollouts

Smart Meter Operations Centre (SMOC) Facilitates

- Platform for business intelligence
- AMI events management
- Centralized project management office
- Enterprise asset management and monitoring
- Consumer and consumption analytics
- Smart metering ROI matrix tracking (e.g. revenue protection)
- Consumer engagement modelling
- SLA management
- Service ticket management for helpdesk
- Training simulator

SMOC Provides Real Time Visibility to End Consumers

- Consumer billing and energy profile information
- Prepayment information
- Consumer centric analytics
- Alerts on account information updates
- Home energy profiles
- Consumer self service
- Cost saving tips
- Customized communication, DISCOM branding, customer service and feedback

AMI 2.0 Provides Decision Support to Optimize Operational Energy Flow with Predictive Analytics

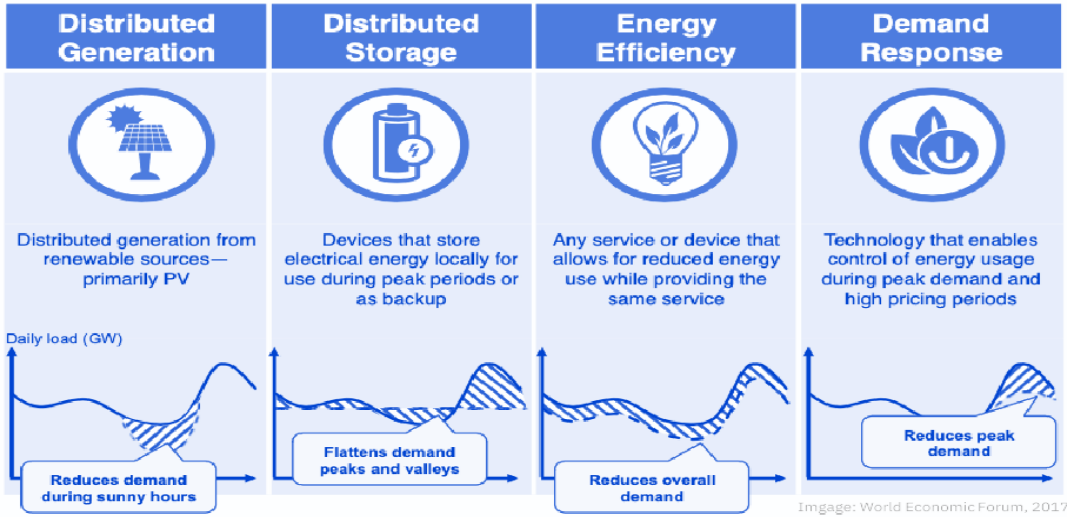
Fulfill Use Cases

- Supply/Demand security on all voltage levels
- Handle congestion management (dispatching)
- Keep grid stable (frequency, voltage) despite and with renewables
- Optimize utilization of grid capacity

Enable/Disable	Basic Conditions
• Distributed generation • Distributed storage • Energy Efficiency • Demand Response	• Safety, efficiency, reliability • As economically as possible • Utilize the grid as best as possible

Approach

- Use ongoing Predictive Analytics (eg: reduce energy transport by linking local producer with local consumers)
- Calculate bespoke maintenance for grid components (e.g. lines, transformers, poles)



The Role of AMI Data:

- Smart meters continuously measure profile data about consumption, generation, voltage, current, frequency, events and power quality data (PQD).
- Over time, a growing AMI data corpus is formed to be used to model forecasts and to detect anomalies.

Thank You

Any questions?

Reji Kumaar Pillai

reji@rejikumar.com

@rejipillai

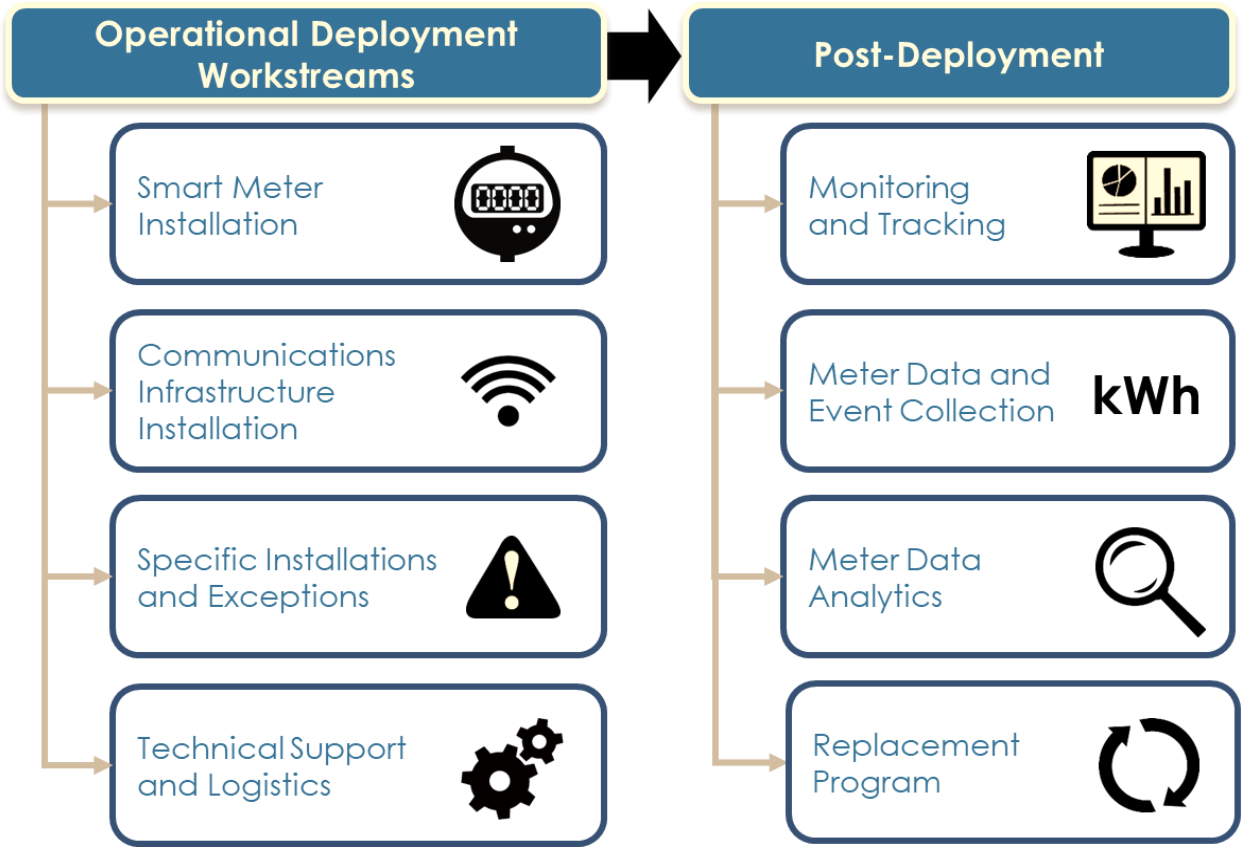
Annexes

SMOC Key Components

- Rollout and installation monitoring
- Meter Data Operations
- Communication Operations & Management
- Insights and transparency of the grid
- KPI monitoring of the metering value chain
- IT operations and integration monitoring
- Alerting and incident management

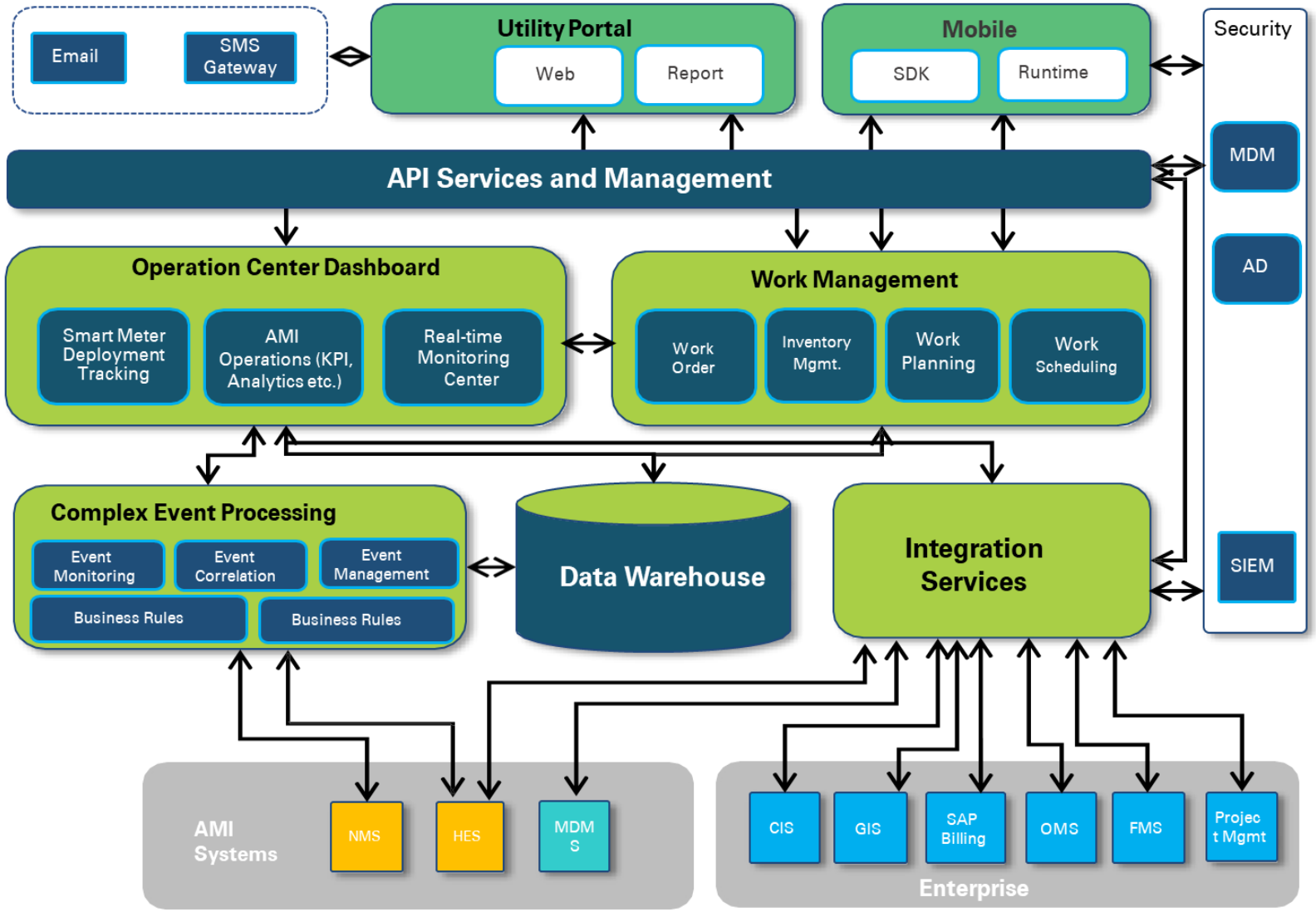
SMOC Solution

- SMOC is designed to process the flood of information unleashed by AMI, apply rules and analytics to drive operational process and give visibility on performance during and post meter deployment



SMOC – Functional Capabilities

- Asset Management
- Workforce Integration
- Real-time Monitoring
- Event Management
- Event Management / Correlation
- Smart Meter Data Management
- Insights from Smart Meter Readings / Register Data
- KPI / Dashboard for AMI Installation & Operations
- System Integration



Meter Deployment Dashboard

- Monitoring of key performance indicators for a mass rollout of smart meters helps identify areas of low performance and areas of improvement

Meter installation vs. activation

Meter installation analysis

Meter deployment completion with remaining days

Overall Deployment Progress

- Month wise plan of meters to be installed
- Actual installed till date (%)
- Installations to go (%)

Work Order

- Planned/Yet to start
- In progress/Completed
- Overdue
- Rescheduled

Customer Appointment

- Appointment rescheduled (Requested by customer)
- Installation not completed (Unforeseen circumstances)