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AGENDA

1. Metering Technology
2. Interoperability Issues
3. Benefits of Smart Meters
4. Deployment of Smart Meter
Metering Technology
Metering Technology

• Metering Technology in Utilities is undergoing major technological revolution

• Thrust areas are Smart Meters, Advanced Metering Infrastructure (AMI), Automatic Meter Reading (AMR) and Home Area Network (HAN)
Smart Meter – Definition -1

• Smart meters is defined as a meter capable of
  – Measurement of energy consumed on time interval basis, as specified by regulatory authorities
  – Provides accurate and timely data on energy consumption to consumers and suppliers
Smart Meter – Definition -2

– Allows electric consumers, suppliers and service providers to participate in all types of price-based demand response programs,
– Provides other data and functionality that address power quality and other electricity service issues.
Key Features of Smart Meters -1

• **Keep Track of Energy Used** – Customer can see energy consumption on TV, Mobile Phone and other display devices and monitor usage over time

• **Remote Load Control** – Switch on and switch off devices like air conditioners, heaters in home by meter using HAN according to remotely settable time schedule or on remote request through communication network
Key Features of Smart Meters -2

• **Export Metering:** To meter energy generated by wind, solar Power etc, when not required

• **Remote Connect / Disconnect:** Ability to cut off and restore supply to customer remotely, and also remote special reading to address the Change of Occupancy

• **Outage detection:** To monitor the status of each meter – Ex to test whether supply has been restored to each house after repair
Key Features of Smart Meters -3

• **Meter Tamper Detection**: To monitor whether meter is accessed without authorization to protect asset and detect theft

• **Remote Time Synchronization**: To keep meters internal Clock accurate without requiring a site visit to check and adjust

• **Quality Supply Measurement and Recording**: To detect and record events such as voltage spikes, voltage sags at each installation
Key Features of Smart Meters -4

- **Two Way Communication between Meter and Utility**: Providing access consumption data and remote control of devices
- **Flexible Tariffs**: To provide time varying tariffs or price based demand response Programmes
- **Payment Mode**: Remote switching between credit and prepayment mode
Key Features of Smart Meters -5

• **Communication Interface**: To allow range of devices like home displays, direct Load control equipment to access the communication network through meter

• **Protocol**: Compliant with IEC 60256 or any Open Protocol

• **Note**: Detailed Technical Specification can be downloaded from

• [www.energy-retail.org.uk](http://www.energy-retail.org.uk)
Interoperability Issues
Interoperability

- Interoperability is the capability of data collection system to exchange data with meters of different makes and the capability of metering Equipment to exchange data with different types of data collection systems.
- GOI Constituted High Level Committee in October 2008 on Standardization of Meter Protocol to enforce interoperability of different makes of meters for both existing and future application.
Protocols Considered

- ANSI Protocol followed in USA and North American countries
- IEEMA proposed MIOS (Meter Interoperability Solution)
- IEC Protocol 62056
MIOS -1

• Protocol developed by 9 Indian meter manufacturers
• Defines data format at data exchange level rather than at meter communication level
• Requires manufacturer to provide interface for each type and make of meters to read meter and convert it to common data format
MIOS - 2

- CFW (Common Frame work) software which invokes manufacturers’ proprietary reading module to read the meter, store data in Common Data Format
- MIOS envisages continuation of proprietary protocols
Recommendations of HLC -1

- Adopt IEC 60256 as National Protocol
- All new meters to be procured shall conform to IEC 62056
- For Legacy meters the options are
  - Replace meter with IEC 62056 Compliant Meter
  - Use API/ MIOS provided by manufacturer
  - To develop and Use protocol Converter to IEC 62056
Recommendations of HLC -2

- Operationalise Implementation IEC 62056 by customising to Indian Conditions
  - standardization of parameters application wise
  - compilation of OBIS codes for parameters, if not available
  - Establish Meter Testing Facilities to test compliance of IEC 62056
IEC 60256 – Operationalisation -1

• GOI constituted a committee in Jan 2009 under chairmanship of DG CPRI to operationalise IEC 62056
• Committee finalized details for 3 Meter categories
  – Energy Accounting and Audit meters for Feeder / DTC
  – Interface Meters/Boundary/ Bank/ ABT / IPP’s
  – Consumer Meters for HT and LT CT meters
IEC 60256 – Operationalisation -2

• Committee did not address 4\textsuperscript{th} Category of Meters – whole current LT meters
• Identified parameters with OBIS codes for 3 categories of Meters.
• A Test Lab was set up at CPRI to test IEC 60256 compliance
• Meters of four Indian manufacturers are tested and awarded IEC 60256 certification
Benefits of Smart Meters
Classification of Benefits

• Benefit Types
  ➢ Tangible Benefits
  ➢ Intangible Benefits

• Benefit categories
  ➢ Operational Savings
  ➢ Supply Side Savings
  ➢ Revenue Protection Savings
  ➢ Smart Grid Opportunities
Tangible Benefits

• Reduced expenses
• Avoided losses
• More effective planning
• Reduction in capital expenditures
• Revenue protection opportunities
Intangible Benefits

• Customer service benefits
• Improved relations with regulators
• Enhancement of your “brand”
• Strategic benefits
Operational Savings - 1

- Reduction in manual meter reading costs
- Addresses meter access problems, that are increasing with heightened concern for security
- Reduction in late and estimated billing costs
- Improved meter accuracy, due to rollout of new meters
- Reduced meter maintenance expense
Operational Savings- 2

• Reduced electronic meter reading equipment (handhelds) expense
• Reduced Load Research expense, as installation of separate Load Research meter is not warranted
• Reduction in Revenue protection losses, due to built in tamper features
• Reduced connect-disconnect expenses
Operational Savings- 3

• Reduced collections expenses
  – Smart meters have capability to provide pre-paid service
  – Prepayment can be done remotely

• Power quality, outage management and reliability improvement
Supply side savings

- Asset Optimization
- Load Forecasting
- Demand-Response
Asset Optimization

AMR System Collects On-Line detailed Load Profile data of every customer and utility devices serving that customer bringing in

- Distribution Planning Savings
- Transmission Planning Savings
- Generation Expansion Savings
- Load Forecasting Savings
Demand Response Savings

Two-way communications network and real time monitoring of demand enables

- Better design of demand response programmes
- Direct load control programs
- Implementation of cost effective and prompt demand control programmes
Revenue Protection Savings -1

- Commercial losses is major Problem of Utilities in India and Number of countries
- AMR continuously monitors 100 % meters
- Meter readers are no longer the “eyes” looking for theft every month
- Deployment of AMR provides an opportunity to detect tampering going on for Long time
- AMR Detects quickly consumption of inactive or disconnected accounts
Revenue Protection Savings -2

- AMR provides real time data for certain types of tampering
- Application software to process and filter tamper data is required to make practical use of AMR tamper data
- AMR alone is not adequate to detect all types of Losses
- AMR in conjunction with CIS and GIS is a Powerful Tool to detect all types Losses
Revenue Protection Savings -3

- Integration of AMR, CIS and GIS provides
  - Study of trends and patterns of energy consumption
  - Compare against similar customers – profiles
  - Identify defective meters
  - Spatial analysis of key parameters like Specific energy consumption etc. DT wise and area wise
Revenue Protection Savings -4

- Savings in expense on squads for Theft detection, Defective Meter etc
- The financial benefit due to reduction of Commercial loss is huge
Smart Grid Opportunities

• Outage Management
• Trouble Call Management
• Power Quality
• Power Reliability
Outage Management -1

- Integration of AMR, GIS and OMS provides
  - Outage Detection runs in real time
  - Outage Detection runs in auto mode in Background
  - Detailed Mapping of Outage Extent up to customer Level, considering network topology
  - Color coding of network showing dark areas
Outage Management -2

• Accurate data for computation of Reliability indices
• Capable of identifying multiple outages in the same area including Individual customer outages
• Outage Restoration monitoring in real time mode
• Ensuring that all customers are restored supply
Outage Management - 3

• Ability to monitor momentary interruption by providing (blink) counters in each meter
• Minimize permanent outages by attending Momentary interruptions
• Avoid problems like flickering / blinking of Lights
Trouble Call Management

- AMR with real-time communication notifies the utility of outages and PQ problems before the customer calls the utility.
- Reduction in customer calls to call centre.
- Ability to verify whether problem is on account of Utility network devices or customer installation before registering Trouble call.
- Reduction in the number of Trouble calls to be processed.

www.metering-india.com
Trouble Call Management -2

- Outages can be more precisely defined
- Investigators can be sent directly to the proper location to effect the most speedy (less costly) service restoration
- Facilitates verification that all customers have actually been restored
  – Before breakdown gang leave the area
  – Before job order is closed out
Trouble Call Management -3

Consequential benefits of better TCM

- Automatic supply restoration verification vs. Checking each customer by Telephone or Visit
- Avoidance of inconvenience to customer & embarrassment to utility, due to non restoration of supply inadvertently
Power Quality issues are:

- High / low voltage
- Voltage sags & swells
- Voltage imbalance
- Momentary interruptions
- Harmonics
Power Quality –2

AMR benefits are

- Voltage and Power Quality problems can be diagnosed remotely
- Substantial Percentage of single no-current and voltage complaints are really customer problems
- Calls to be investigated in the field will be reduced
- On detection of PQ problem, Utility can notify customer problem detected and action contemplated without waiting for customer compliant
Power Reliability

- AMR provides the means to reduce outage duration by speeding up the process of Fault detection, Isolation and Power supply restoration.
- Reduced outage duration improves reliability indices such as SAIDI, CAIDI, ASAI, and others.
- Improved reliability indices can bring in big cash benefits, if Regulator adopts Network Performance Based Tariffs.
Power Reliability -2

- Improved reliability indices save maintenance and restoration costs
- Substantial cost savings by avoiding increased work force required to achieve same Performance Levels
Deployment of Smart Meters
Why state Intervention - 1

• Accurate and timely data on energy consumption to enable informed decisions on energy use, thereby reduce carbon emissions is possible only with smart meter deployment
• Studies show that deployment of smart metering Technology is cost effective & viable
• Government Interventions is required as supplier may not be able to capture all benefits and may limit deployment to 20% to 30% of meters where high commercial case exists
Why state Intervention - 1

- Regulation and legislation are enacted by several Governments encouraging or making deployment of smart metering mandatory
Smart Meter Deployment In UK - 1

- Target Deployment 47 Million Meters
- Time Frame 2020
- 3 Market Models have been evolved

1. Competitive model – All elements of delivery are supplier-led, generally utilizing existing market structures. Supplier is free to determine his deployment strategy
Smart Meter Deployment In UK - 2

2. Centralized communications model

- A National communication network is put in place to support smart metering
- Communication service provider is selected on national basis through tendering for Time based contract
- All suppliers obliged to use central communication network via License
- Provision and installation of meters is left to suppliers
3. Fully Centralized model

- A national communications network as in case central communication model
- Regional Franchises to manage Meter selection, installation and maintenance
- Time based franchise is awarded by competitive bidding to deliver meter services to all suppliers
Competitive Model –1

• Supplier is responsible for
  – Communication between meter and data retrieval interface system
  – contracting the services of multiple Communication service providers and multiple communication protocols
  – Maintain and store Individual meter details, communication type, IP address etc
  – Data presentation to and from meter
  – Providing authentication and encryption keys
Competitive Model -2

- Supplier sends the request for meter data via the communication service provider (CSP) to meter, with technical details of Meter
- CSP acts as a conduit and forwards the message to the meter
- On receipt of the request, meter passes the requested data, after authentication to supplier via CSP
- Supplier again authenticates source and then decrypt data for interface system.
Competitive Model - 3

• In the event of a failed response, it is the responsibility of supplier to advise meter operator to investigate and fix the issue.
• If problems relates to communication infrastructure than meter operator fixes it in liaison with communication service provider.
Central Communication Model – 1

- Central communication service provider is responsible for
  - Communication between meter and interface system
  - Deliver data in standard format to supplier
  - Responsible to maintain meter technical details like physical address details presentation layer, authentication and encryption details
Central Communication Model -2

• Supplier sends the request for meter data directly to the central communications provider
• Communication collects meter technical details and forwards data request to meter
• On receipt of the request after authentication the meter passes the requested data to communication service provider
Central Communication Model -3

- The communications provider then sends the requested data back to supplier in a standard format and via a single interface.
- In the event of a failed response it is the responsibility of the supplier or agent to instruct meter operator to investigate and fix the issue.
- If problems relates to communication infrastructure than problem is fixed by meter operator in liaison with communication service provider and supplier.
Fully Centralized Model

• Fully Centralized Model and Central Communication Model are same but for the difference that meter operations are managed by regional Franchises in FCM, whereas in CCM by meter operator appointed by supplier
## Economic Summary

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<tr>
<th>Model</th>
<th>Cost GBP Billion</th>
<th>Benefit GBP Billion</th>
<th>Net Benefit GBP Billion NPV 2009-30</th>
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Source. Baringa Report  April 2009
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<th>Benefit</th>
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<th>Estimate Benefit</th>
<th>Benefit</th>
<th>Total Benefit</th>
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<td>Time of Use Tariffs</td>
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<td>call center(back office)</td>
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<thead>
<tr>
<th>Item</th>
<th>Capital cost (GBP)</th>
<th>Annutised Annual cost per meter per Year</th>
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**Assumptions**

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<th>Item</th>
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<td>O&amp;M</td>
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<tr>
<td>Cost of Capital (per year)</td>
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Increase in Legacy Meter Reading Cost due to rollout of smart meters 4 times the normal cost
Key Conclusions

• Study on Deployment of Smart Meters in UK is Technically Feasible Economically Viable
• Similar study shall be conducted for Roll out of smart Meters In India
• Study need for Centralized Communication Infrastructure as proposed in UK study
• Draw a national plan for Smart Meter deployment
• Prepare a Technical Specification for Smart Meter at National level
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