Technical Paper Presentation

"Validation of Smart Metering Technology"

Speaker : ***Rajesh Bansal****, CEO, BSES Rajdhani Power Ltd*

Changing Power Distribution Scenario

- Greater integration of Renewable Energy
- Growth in Rooftop Solar
- Need for Electric Vehicle charging infrastructure

→ Larger variation and unpredictability in the net power demand curve.

- Consumer Engagement, DR
- Consumer and other stakeholders expectations

→ Creation of long-term customer loyalty

- Technological advancements
- Infrastructure requirements

→ Require significant investments

‘ Evolvement and adoption of Smart Metering Technology in evitable ’

Smart Metering empowers Utilities to address Objectives

Meter reading is an activity not objective

- Increase Customer Satisfaction and Customer Engagement
- Renewable Integration
- Power Reliability and faster outer management
- Revenue Enhancement and Leakage Protection
- Network optimization – Reducing Technical Losses
- Demand Curve Management
- Reducing Capex and Opex – Cost of Supply

Key Objective: Safety of Network, Employee and Safe usage of Electricity

Product and System are different --- Few Field Experiences encountered

- LV CT meter and the LV CT box tested individually, they were accurate, when coupled, the composite accuracy was out. In other words, the standalone and integrated behaviours can be different.
- When a ‘disconnect’ command was given, many meters did not disconnect. Reason - meter feeding power to the network went off first and affected the travel of the command to the remaining meters.
- At a particular location, a smart meter was found malfunctioning with intermittent functioning of load relay. The fault continued even after the meter was replaced. Later same was tracked to powerful magnet of speaker , impacting the performance.
- At a utility, many customers suddenly lost supply. This was tracked to a server having given a command to switch off but the ‘why’ and ‘how’ need investigation.
- A meter reader reported, ‘No display/ display not working’. When checked, the audit team found it working, indicating an intermittent behaviour.
- A smart fire sensor connected to the server was found less effective compared to conventional sensor connected directly to the relay. Time is critical in protection with delays due to signal travel from sensor to server to switchgear RTU.

Need for Smart Metering Validation

- System integration complexities
- Rapidly evolving communication systems and technology
- Difference in value realization for each Utility
- Achieving Utility Objectives
- Malfunction / Failure experiences encountered

Smart Metering is a tool, not a solution. It is an integrated system, not a standalone product.

“ The key question is how to ensure that the chosen ‘Smart Metering Integrated System Tool’ is effective and is the right one with the required capabilities to empower the utility to achieve their desired objectives ”

So, what is the Solution - ??? **‘Validation of Smart Metering Technology’**

“ Validation is a process to ensure functioning of the system to meet the objectives without failure or malfunctioning in any field condition and to ensure the ‘return on investment’ and no regrets about the technology ”

Broad Parameters to be considered:

- Testing far beyond testing applicable standards or specifications
- Product testing w.r.t. conditions experienced in the field
- Identify limitations of the system
- Validation plan considering very high stake of Utilities
- Metering system life
- Cyber Security and Data Security

An error in a bill can be a headline in the next day’s Newspaper.

Planning and Preparation of Validation Process:

- **What should be Validated ?**
- **How should Validation be done ?**
  - Objectives : Short Term, Long Term
  - Technology Adequacy to address objectives
  - Adequacy of Data, correct framing Logics for Events, Alerts
  - Processing, Analysis and Storage of Data
  - Inferences and Planning Actions
- **Who should do the Validation ?**
  - In partnership with Vendors, Independent Test Labs and Other Utilities (Biggest Stake)
- **What initial preparation is required ?**

  1. Manpower training 2. Test set up 3. Interpretation of validation results

Validation Chart : Smart Meters

Sr.	Validation Test	Technical Brief about Test	Making Inference
1.	Effect on abnormal conditions on alerts, events and measurement of parameters	Abnormal conditions can be environment, installation, external influence parameters, power on-off, chattering, abnormal electrical conditions.	Check impact in normal and abnormal condition, even temporary inaccuracy impacts the overall utility functioning. Critical are conditions which can be a potential tampering method, or which are undetected, and damage is temporary in nature.
2.	To use unauthorised means to change data, memory content, software, settings.	By sending signal using various means.	Any data change, logging, alerts, criticalness of parameters.
3	Failure of susceptible meter components/ subassembly	Typically display, power supply, latching relay are more prone to failure.	To analyse the condition when these have failed.
4	Wrong alerts, events and alarm generations	Alert, event and alarm has a purpose and call for action.	To analyse how much misleading and the frequency.
5	Malfunctioning of latching relay or communication module.	Susceptible to external condition and spurious signals, e.g. an array of on/off commands.	The more components, greater the probability of failures. Need to make inference about acceptability of failure, its impact on measurement, event logging/detection.

Validation Chart : Communication , HES & DAS System

Sr.	Validation Test	Technical Brief about Test	Making Inference
1.	Effect on signal fidelity, time response with population (of communicating simultaneously).	To ensure if a message/command when broadcasted, should not affected by population size or if big data is uploaded simultaneously by large population of meters,	Need to plot a chart between response time and population, incidence of data corruption or data lost. Need to further ensured along with no jamming of network/HES due to heavy traffic.
2.	Impact of failure/power outage of other (say neighbouring) meter, DCU etc. on communication.	If meter is getting power, it should communicate. Also to check impact of power on/off/chattering during communication.	
3	Response for a command to get a particular data set from a meter vs actual data received.	Get specific data or set of data including data which is not requested.	Impact on response time, further processing and storage.
4	Meter behaviour if a command in form of spurious data is sent to meter.	Aim is to corrupt/alter meter memory data and/or software. .	Whether any corruption/alteration of memory and also logging of such incidents.
6	Adequacy of command generation security system, based on criticalness of command and its impact.	Criticalness is to be evaluated in terms of impact on meter functioning, on consumer, on stored data and volume of consumers.	Are adequate measures taken to ensure minimal damage due to unintended/unauthorised users by introducing checks. Authorisation based on criticalness
7	Interoperability at meter, module, communication media, HES command level	Alarm/ alert/ data generated and sent by meter should be understandable by HES/ server. Communication module and network behaviours should be same irrespective of make.	Devices on open source should work on same command set, irrespective of make. If interoperability is for limited make, then entire approved make should have uniform behaviour. Support in new make is added at any level.

Validation Chart : MDMS and Smart Apps

Sr.	Validation Test	Technical Brief about Test	Making Inference
1.	Accessibility of stored data for processing or needed in any application modules.	Faster accessibility and data format planned to ensure no dependency on meter type, its age, etc.	Need to check if same database/ data needed simultaneously on multiple modules.
2.	Validation of smart apps whether developed as per philosophy planned to achieve objective.	The best ways to run application on any data available and let user use it in field, based on the data available.	This need to be done on actual field data. Many tests can be done on existing static meter data also.
3	Availability of data to run any smart apps. If apps works on online data, check response time.	If meter is getting power, it should communicate.	
4	Simulating conditions due to which one can change data or can corrupt data.	Also to check impact of power on/off during communication..	Are adequate measures taken to ensure minimal damage due to unintended/unauthorised users by introducing checks, restricting impact. Authorisation based on criticalness.
5	Ease to make own logic, queries for analysis.	Duly authorised person should be able to access the data. Also check impact of running such queries on overall system performance.	

Conclusion:

“ Planned and proper validation of new technologies, including driving the correct inference from the validation test results, can help both the service provider and utility to avoid surprises and regrets at a later date.

It is recommended to spend time and resources on validation rather than feeling helpless or frustrated later. ”

Thank You

For discussions/suggestions/queries email: www.indiasmartgrid.org
www.isgw.in

Given below is the link of technical paper on ''Validation of Smart Metering Technology'' authored by Sh Rajesh Bansal, CEO, BSES Rajdhani Power Ltd.

https://www.smart-energy.com/industry-sectors/smart-meters/validation-of-smart-metering-technology/

India Smart Grid Forum
CBIP Building, Malcha Marg,
Chanakyapuri,
Delhi-110021
Website: www.indiasmartgrid.org