Utilities

TATA

TATA POWER

BSES

BSES Rajdhani Power Limited

BSES

BSES Yamuna Power Limited

NPCL

NOIDA POWER COMPANY LIMITED

PARTNER

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India Smart Grid Forum

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DEPARTMENT OF SCIENCE & TECHNOLOGY

NITI Aayog

MINISTRY OF POWER
GOVERNMENT OF INDIA
CENTRAL ELECTRICITY AUTHORITY

India SMART UTILITY Week 2025

Session :

Empowering the AMI-SP Ecosystem – Interoperability & Real Time

Presented By

Jaideep Singh ,Advisor to Radius Synergies Intl Pvt Ltd

XENIUS
Powered by XENIA

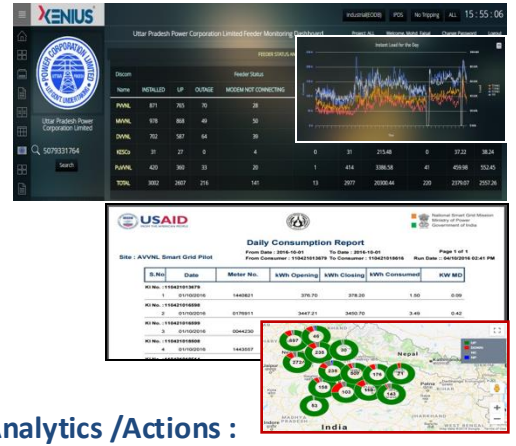
Empowering the AMI-SP Ecosystem

- ✓ Wish list
- ✓ Role of Govt (MoP, Policy makers ,Regulators, DISCOM)
- ✓ Testimonials – Key Drivers
- ✓ Leveraging AI/ML – Interoperability & Real Time monitoring
- ✓ Overcoming challenges
- ✓ Smart Homes – Meter as a HUB
- ✓ Way forward

AMI Ecosystem -Ask

Asset Health check :
- Transformer Load kWh & kVAh
- Phase voltage & Current – circuit
- Power factor –network
- ⚠ t Temperature
- Coordinates
- AT&C loss
- Revenue Loss
- Prevent break down maintenance due to phase /load imbalance

Instant Alerts:
- Voltage variation
- Phase Imbalance
- Max Demand
- Low Power Factor
- Ambient ,Oil , winding temperature
- Sags and swells
- Trip conditions
- DI/DO port - status Update



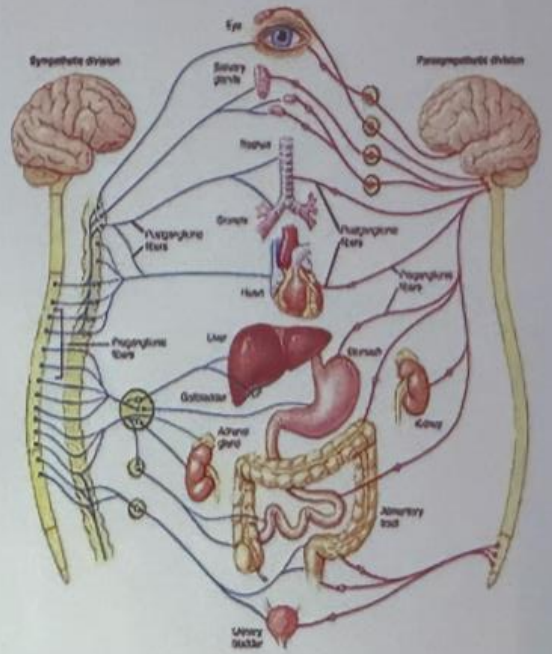
Un-addressed Challenges
- Interoperability
- Near Real Time Data

Benefits
- Outage monitoring and management
- Automated DT health check , AMR , billing
- T&D loss reduction by audits / consumer load re-arrangement /allocation
- AT&C loss reduction
- Improving quality of supply –Reliability Index

Analytics /Actions :
- Instantaneous alarms
- High granularity data for near real time action
- Actionable alerts
- Alerts to designated officials along with escalation mechanism
- Artificial intelligence for predictive / preventive maintenance
- ERP integration
- Approx Revenue Loss in Rs Value
- Consumer experience & Satisfaction
- Centralized Monitoring

Importance of Communication system and Cyber security

- Two-way communication
- Real-time monitoring, control and configuration
- Optimized performance
- Cyber threat protection



India Smart Utility Week 2025 | 18 – 22 March 2025 | www.isuw.in

Slide 3

(Analogy- Human Body- Organs work in synch- Zero communication errors)

Interoperability - Wish List

Within the Components in the AMI chain

- ✓ Smart Meter
- ✓ Head End System / MDM
- ✓ DCU/Gateway
- ✓ Communication Module i.e. Network Interface Card (NIC)
- ✓ ERP/ Billing integration with the Utility (not be be ignored)

Within these layers to operate efficiently , seamlessly with reliability , ring fencing themselves from

- ✓ Perils of proprietary technology / solutions
- ✓ Large scale field failures
- ✓ Obsolescence Tech
- ✓ Business closures vendor
- ✓ Inventory management complexity
- ✓ Intra –DISCOM interoperability (Packages / Multiple AMISP's) challenges
- ✓ Loss of centralised Analytics / Monitoring (Single SFMS & SCMS)

Interoperability - AMI-SP - E2E

Broadly Categorised :

System Level

- Multiple Head End System (HES) / MDM
- Between 1&2 TSP's
- Either Cellular or RF connectivity
- Cloud migration
- ERP integration

Device Level

- Smart Meter (Multiple makes)
- Smart Meter Communication Module – Swappable NIC –Plug & Play

(Interoperability between multiple make of devices and makes of system)

Interoperability – Competition Commission India (CCI)

"…the interoperability of data in smart meters between the DISCOMs can contribute to healthy competition by promoting a non-discriminatory and transparent procedure while removing entry barriers for new entrants. Further, due to the interoperability of the smart meters, the behaviour of the competitors will change as per the Nash equilibrium theory, which states that the distributors will make the best decision…"

"…the competition in the energy sector will also help in the efficient and low-cost use of services by the providers and consumers. A number of players would be able to access real-time data services which would help with the overall growth of the energy sector, especially for the distributors.."

(No one dominant strategy will prevail- level playing- acknowledges interop/real time…CCI)

Interoperability – NIC Standardisation

- ✓ Adaptor modules that align with the pin configuration of the meter at one end and with the NIC at the other (existing installations)
- ✓ Standardisation of the size , form factor cradle slot and defined PIN config – under review by BIS (future deployments)
- ✓ Decouple the NIC by standardising its design and features , since meter manufactures are only domain experts in metrology (Regulators & Policy makers to review)

(Swappable plug and paly modules)

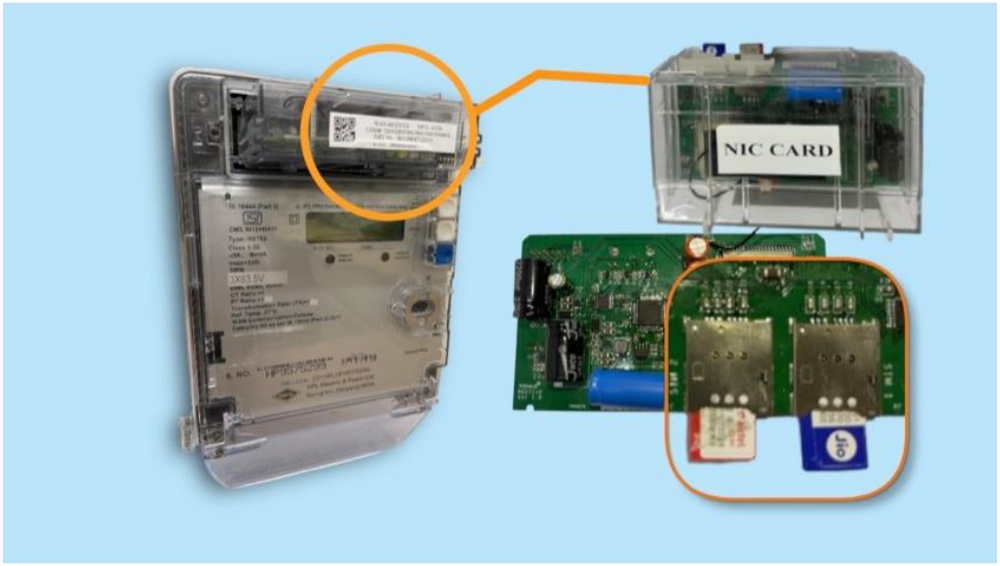
Interoperability – NIC Adaptor Module-Plug& Play

Adaptor Plate with meter specific PIN config female/male (multiple make of meters)

+

NIC card docs on to the adaptor plate

Interoperability – Communication- NIC-Dual SIM



- ✓ Seamless switchover from TSP1 to TSP2 vice versa - interoperable
- ✓ Mitigates loss of communication due to poor signal strength
- ✓ No loss of data –Real time / date stamping authentication
- ✓ SLA’s maintained

Interoperability – Communication- NIC Cellular + RF

Cellular Stack or RF Stack- swapable or Hybrid in the same NIC

- ✓ Allows Seamless switchover from cellular to RF vice versa
- ✓ Mitigates loss of communication due to poor signal strength
- ✓ No loss of data with Real time , date stamping authentication
- ✓ Mesh networks optimize cost of deployment –DCU less architecture
- ✓ SLA's maintained

Vision - Honourable Minister (MoP) ,Govt of India

"NFMS, a flagship initiative of Ministry of Power, entails access to detailed information related to ***real time(,) hours of power supply, power outages and overall health*** *of ~2.5 lakh feeders (11 KV outgoing) across the country. This system will enable stakeholders to make informed and actionable decisions, thereby bringing in transparency, efficiency and accountability to distribution utilities (DISCOMS), ultimately improving the quality and reliability of power supply to the end consumers. The project involves integration of master as well as transactional data with 87 Discoms…….monitor and analyse* ***real time data from multiple sources*** *and maintain the data sanctity in the NFMS portal …."*

(Data- delays of > T-1 days)

F. No. 26/9/2015-IPDS(Vol.II)(Pt.)(238595)
Government of India
Ministry of Power

New Delhi, Dated: 07th August, 2020

To

Pr. Secretary/Secretary (Energy) of all States/MDs of all DISCOMs

Subject– Road map for shifting over to smart/prepaid meters within the next 3 years.

Sir/Madam,

Kindly refer to this Ministry's letter of even number dated 02.08.2019 and letter dated 16.08.2018 (copies enclosed) requesting for drawing up a road map for shifting over to smart prepaid meters or prepaid meters within the next 3 years. The replies including the road map is still awaited.

2. The major reasons for high AT&C losses include non-billing, wrong billing, thefts, non-collection of the billed energy etc. All these reasons have an underlying factor, i.e a human interface. Prepaid metering will allow Utilities to address these issues by replacing human interface by technology. It will also enable consumers to use electricity as per their own requirements and budgets. In areas where prepaid metering has been introduced the AT&C losses have gone down sharply. In Manipur, the losses have come down from 47 percent to 15 percent.

3. It is therefore in the interest of Utilities to shift to prepaid mode- whether prepaid smart metering or simple prepaid metering – at the earliest. Prepaid smart metering would have some added advantages such as remote tariff updates; real time energy audits and TOD tariff- but the choice of whether to go in for prepaid smart metering or simple prepaid metering vests with the States. The essential requirement is to shift to prepaid to do away with manual interface and reduce transaction costs. It is requested that the shift to the prepaid system may be taken up and progressed phase wise. It is requested that this Ministry may be kept apprised of the action taken.

4. This issues with the approval of Hon'ble Minister of State (I/c) for Power, & NRE and MoS for Skill Development & Entrepreneurship.

Yours faithfully,

7.8.2020
(Mritunjay Kumar Narayan)
Joint Secretary (Distribution)

DoEA , MOF GoI - Outlay Plan & Outcome –Bihar

आर्थिक कार्य विभाग
DEPARTMENT OF
ECONOMIC AFFAIRS

Login Register

Best Practice Information Media Organization Structure

will facilitate near real time identification of loss pockets. It will also help in formulating the strategy and taking corresponding steps for plugging the loopholes in unauthorized use of electricity, thereby having significant reduction in AT&C losses.

- **Consumers Benefits:-**
  - No RC/DC (Reconnection/ Disconnection) charges levied to the consumers. Further no disconnection takes place during weekly/ public holiday & beyond office hours of 10.00 A.M. to 2.00 P.M.
  - Additional rebate in Energy Charges making a total rebate of 3%.
  - No need of separate net meter in case of installation of Grid Connected Roof Top Solar Plant by consumers.
- **Monitoring of consumption / Credit/ Debit** through Consumer Mobile App for controlling the consumptions/usages of energy by the consumers.
- **Removal of manual intervention** in Meter Reading and Bill Distribution thereby providing objectivity which lead to increase in operational efficiency and resource optimization by effective management of resources involved in meter reading, billing, collection. Ultimately it will be passed on to the consumer through tariff.
- Facilitates **Demand Side Management** at consumer level by DISCOM.
- Satisfied people in terms of **error free billing** with Pay as per Use, additional rebates, clarity on disconnection/reconnection process, real time monitoring of its usage etc.
- DISCOMs Viability in terms of **real time monitoring** of all revenue & energy management activities, minimum manual intervention and backend analysis of targeted action plan based on **Artificial Intelligence**.
- Impact on **Socio -Economic environment** of the State in terms of skill development, job opportunities, saving of energy resources etc.
- **Better cash flow** for Distribution Companies due to advance payment by consumers and thereby gradual reduction in burden on Government.
- Ensure **timely/ advance payment** of power purchase cost thereby taking the advantage of rebate as well as non-levy of penalty.

Near Real Time – Policy Makers - SBD

Appendix – A Guidance Note issued REC MoP GoI.

1. Desirable Parameters of Proposed System (Feeder Meter Monitoring)

 The proposed Feeder Monitoring System is expected to provide continuous online monitoring and logging of essentially, though not limited to, the following parameters

- *o Voltage (Phase to phase and Phase to Neutral)*
- *o Current on each phase*
- *o Energy- Active, Reactive, Apparent*
- *o Power- Active, Reactive, Apparent*
- *o Average Power Factor*
- *o Frequency*

 The proposed system is expected to provide continuous online monitoring and logging of abovementioned parameters and capability to disseminate information on web-based application for :

- *o Number of system outages*
- *o Duration of system outages*
- *o Peak Load of feeders*
- *o Voltage Profile of Feeder*

Near Real Time – Policy Makers -SBD

Annexure H
Future Demand Response Program Use Cases for Reference (SBD)

The objective of the Demand Response is to optimal utilization of energy resources by uniform distribution of load across the day, to save additional investment in capacity addition within the utility, improved access of power to rural areas, reduction in technical losses, enhanced consumer satisfaction by load curtailment in place of load shedding……..

3. Real time Pricing , Utility shall be able to send real-time pricing signals to end consumers/ AMI system

(such use cases demand for NRT data)

Near Real Time – Testimonials

Way forward

With the initiation of the smart metering programme, Assam has paved the way for modernising its power sector. The next step is to leverage advanced technologies and harness meter data for more than just billing and cost savings. The true potential of smart meters lies in leveraging cutting-edge technologies such as AI and ML tools to create value for utilities and boost energy efficiency. By utilising AI algorithms and the Internet of Things, utilities can gain real-time insights into energy consumption patterns, encouraging the adoption of energy-efficient practices and ultimately contributing to reduced carbon footprint.

Inetellismart Assam

Demand Response Programs: With smart meters, utilities can implement demand response programs that incentivize consumers to reduce or shift their electricity usage during peak demand periods. By providing real-time pricing information, smart meters empower consumers to make more informed decisions about their energy usage.

Regulatory Intervention for Time-of-Day Tariffs

Implementing a universal Time-of-Day (ToD) and Time-of-Use tariff regime is the next important intervention in the program. This would enable the consumers to differentiate between peak and non-peak tariffs, incentivise targeted consumption and driving traction towards smart meters. It also helps manage demand peaks for Discoms using smart meters.

ED REC

Near Real Time – Testimonials

The increased granularity of electricity consumption allows DISCOMs to pinpoint areas of inefficient system operation and predict future system upgrade requirement better. Having near real-time information of energy consumption and flow across the networks also give DISCOMs very valuable information to aid in system planning for load growth.

MD APDCL

MD &CEO Intellismart

Granular Data Collection: Smart meters provide detailed, real-time data on energy consumption at the individual consumer level across various time-blocks. This data granularity is crucial for utilities to understand usage patterns, identify inefficiencies, and optimize energy supply across the grid.

Two-way communication: Unlike traditional meters, smart meters enable two-way communication between consumers and utilities. This facilitates real-time monitoring of outage detection, electricity thefts, and enables more efficient resource allocation.

- DT and 11 kV feeder metering: DT and feeder metering measure energy consumption in a distribution network and indicate a utility's ability to improve energy accounting, track losses, and take corrective action. The DT meters provide real time information about voltage, power factor, current, harmonics, and phase imbalance from the LV network; and based on this information, utility companies can utilize specific remedies to solve problems as they occur. It is interesting to know that although all utilities except Bihar North,

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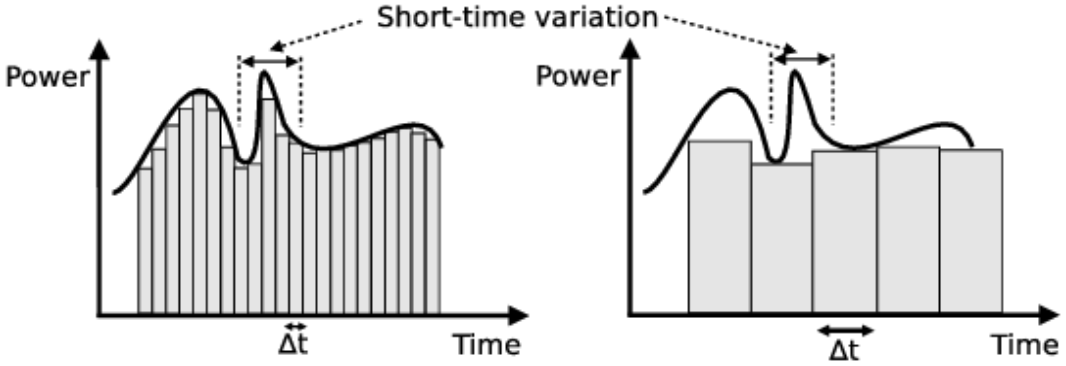
Real Time / Near Real Time – NIC + HES



- ✓ **Higher sampling rate – Higher granularity- > data points > accuracy**
- ✓ **Data acquisition < 90 sec – like online live streaming**
- ✓ **Faster processing and computing –Edge Intelligence**

(real time in the true sense explained in simple terms no delays / buffering)

Near Real Time – Distributed Computing & Edge Intelligence @NIC

Standard NIC

+

Independent Microcontroller

=

Intelligent NIC-

(distributed computing at NIC for optimal utilization cloud resources)

1. AI / ML Platform
2. Edge Intelligence
3. Learning/Listening mode
4. Secure stealth mode
5. GPS (Geo fencing)

(learnt behaviour it knows its next action building redundancy during loss of connectivity , reduction of carbon foot print by optimising cloud resources)

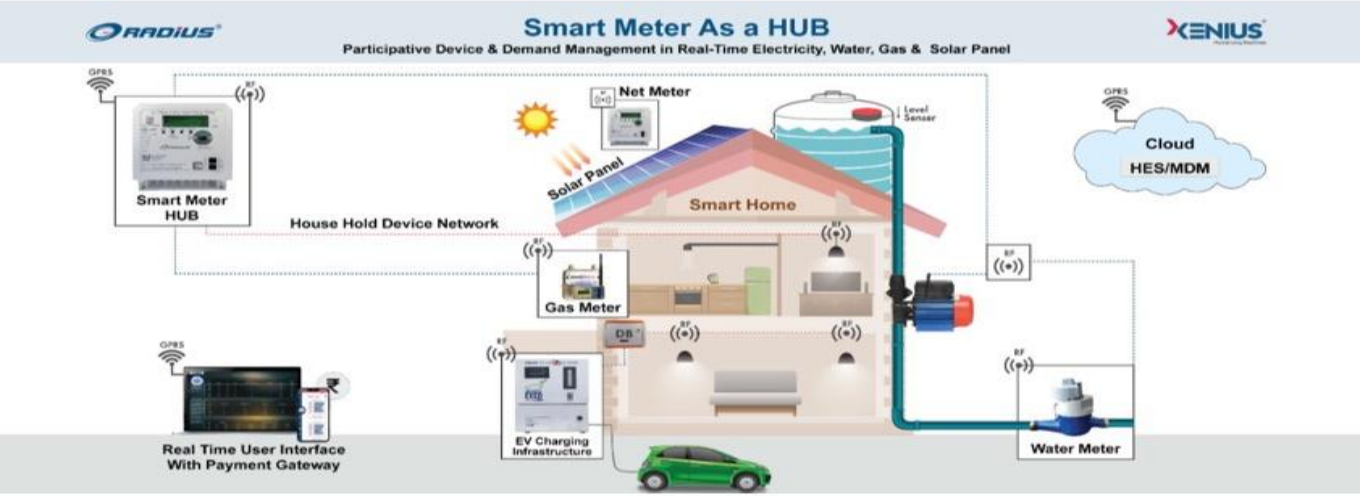
Near Real Time – Cyber Security-Disaster Management

Attacks & Breaches happen at the weakest link where data is transmitted – Meter/NIC to the HES/MDM layer via the air to the cloud .The potential threats to disrupt networks & cause cascading effects are :

- ✓ Injecting fake data (V,I, Pf, Kw, Kwh .)
- ✓ Running commands like connect, disconnect.
- ✓ Clone the telecom service provider network and take control of the latched devices.
- ✓ Clone UPI's /Payment gateways – Financial frauds

Continuous data capture in real time provides a microscopic view of the network behaviour helping in spotting suspicious patterns & anomalies indicating an oncoming cyber-attack or man in the middle , earlier on , thus preventing disasters.

Future Smart Home ! Meter as a HUB Electricity / Water/ Gas



Conv EWG – Participative device & demand mgmt.-P2P,V2G need for NRT with interoperability

Way Forward

- ✓ Adopt the best practices & technologies –validate
- ✓ Keep pace with AI/ML, weave it in fabric of the power sector
- ✓ Policy makers , Regulators and DISCOMs pls demand -Interoperability & Real Time
- ✓ Safe guard the investments from ills of obsolescence and ignorance
- ✓ Work towards drawing the best outcomes for every rupee spent
- ✓ Promote Make in India
- ✓ Make the RDDSS & many other such Govt. schemes a success , work towards…

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THANK YOU

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