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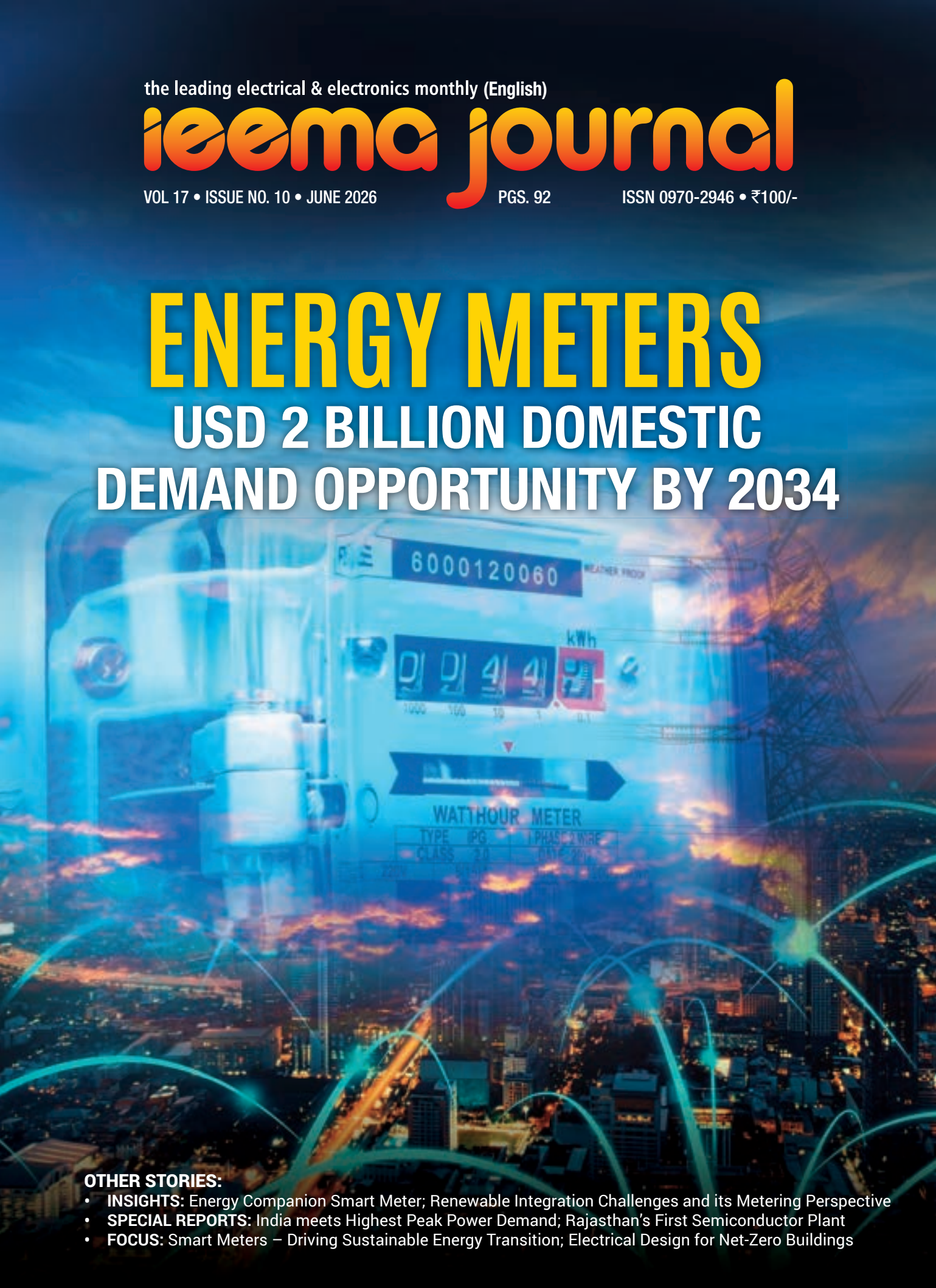
ENERGY METERS

USD 2 BILLION DOMESTIC DEMAND OPPORTUNITY BY 2034



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Empowering Consumers Through Smart-Prepayment and Tariff Reform: NBPDCL (AMI) Learnings

This paper by **Mukesh Hingar, Bhavik Talesra and Lokesh Devpura of Secure Meters Limited** presents a technology-enabled model and implementation-ready plan derived from the North Bihar AMI roll-out programme at scale. It demonstrates how technology can help in structured consumer onboarding across pre-installation, installation, and post-installation phases.

Advanced metering infrastructure (AMI) delivers multiple benefits to consumers and all involved stakeholders. However, it has always been challenging for utilities and AMI service providers (AMISPs) to gain consumer trust. This paper explains how to leverage this technology.

Winning Consumers' Trust

Tariff Reformation to Empower Consumers

In mass rollout, consumer hesitation arises from disconnection, unclear recharge or payment mechanisms, and distrust in deductions. These challenges further intensify in 'No-WAN' scenarios, where network uncertainty creates disruption. From a technical standpoint, it is critical that fall-back mechanisms, local communication interfaces, and edge intelligence (tariff engine) ensure consumer convenience and protect utility revenue.

This paper presents a technology-enabled model and implementation-ready plan derived from the North Bihar AMI roll-out programme at scale. It demonstrates how technology can help in structured consumer onboarding across pre-installation, installation, and post-installation phases. User-friendly fall-back technologies (eg, BLE – Bluetooth), balanced man-machine interface, and robust prepaid and tariff engine deployed can significantly improve adoption, strengthen payment discipline, enable flexible debt recovery, and prepare consumers for tariff innovations such as time of use (TOU). When designed correctly, this approach builds trust at scale and delivers replicable utility outcomes.

1. Introduction

In India, we are amid a significant transformation with the nation-wide drive to roll-out smart metering systems[1], propelled by ongoing technological innovations and the evolving role of consumers as prosumers.[2]

During large-scale roll-out of smart metering, consumer resistance is not only because of technology but because of trust and transparency. However, reliable solutions when designed thoughtfully around consumers' need, help in winning consumers' trust. Furthermore, AMI deployment along with user-friendly technology can make utilities financially viable by reducing aggregate technical & commercial (AT&C) loss and theft, thus enhancing operations.

In addition, communication disruptions ('No-WAN') can make consumers feel disconnected. Therefore, the AMI architecture must include fall-back options that remain functional in the absence of WAN connectivity.[3] Technology must solve consumer challenges, not amplify them.

Unlike most AMI literature that focuses on architecture or financial viability, this paper offers a technology-enabled, field-proven, replicable, consumer-centric model that directly links engagement maturity with technical readiness for tariff innovation.

2. Consumer and Utility Apprehensions

Consumers have their own set of apprehensions when it comes to smart metering roll-out and these apprehensions are further influenced through social media, community, etc.

Apprehensions of Consumers

Perception that smart meters record higher energy or runs faster

Fear of online recharge and payments

Unexpected or time-inappropriate disconnections (eg, late night)

Lack of trust in utilities and service providers

Apprehensions of Utilities

Return on investment (RoI)

Data privacy and privacy concerns

Fear of losing operational control

Concerns regarding resource reallocation

3. The Engagement Model: A Detailed Blueprint

Recognising that these apprehensions could directly impact the roll-out and intended value delivery, the North Bihar AMISP project was designed to ensure consumer confidence matures before consumer compliance is expected, ie, consumer-first and consumer-centric approach. This blueprint was supported by technology-driven interaction and diverse trust-building mechanism(s).

3.1. Phase A – Pre-installation: Awareness → Understanding → Trust

This phase prepares consumers before smart prepaid meter installation begins and creates early acceptance.

Utilities and AMISPs can handle queries and avoid fear among consumers while explaining advantages of technology-enabled smart meters in the following ways:

- Operating prepaid meters are just like running prepaid mobile; consumers can see their consumption pattern and control accordingly.

- Integration with multiple payment gateways and different platforms are there to make consumers' life easy and convenient for recharging the meter. Consumers are not dependent on a single outlet.

- Like a bank account, it is quite easy to check the available balance in the meter, see consumption profile, and get alerts to avoid disconnection due to payment exhaustion.

- Quick support in mobile application for consumer query or 24 x 7 call centre is available to assist.

In parallel, utilities and AMISPs must prepare a consumer-facing continuity (contingency) plan for 'No-WAN' scenarios – ensuring that basic interaction (eg, balance check, diagnostics) is supported through local wireless user-friendly technologies as a fall-back option.

Methodology and multi-channel campaigns

Explaining the recharge or payment mechanism and overall functionality of smart prepaid meters using demo-boards, installation at common areas or public places can help in establishing trust.

Also, spreading messages through campaigns, nukkad-nataks, broadcasts, and social platforms (like engagement sessions with local governance, panchayats, schools, industries, etc) can help enhance awareness using culturally relatable messaging.

Trust-building

Involvement of utility officials, administration, and local influencers establishes social proof and reduces misinformation.

In a nutshell, it is like preparing a ground before the actual play – shifting the mind-set from apprehension towards adoption.

3.2. Phase B – Installation: Onboarding → Support → Confidence

Installation is the consumer's first operational contact with AMI technology, and it must create confidence through live interaction and reliable usability.

Hybrid model to support installation acceleration

BLE or similar low-power local wireless technologies can boost the installation if used along with existing cellular or RF technology for smart meters. For instance, installers can link consumers at backend, download configuration, and complete seamlessly while establishing a cellular link with backend system through their own mobile and forming a high-speed link with meter using local wireless technology.

Live demonstrations during on-boarding and support

During installation, installers should share documents like know your meter (in consumers' local language), FAQs, and few key functionalities

Spreading messages through campaigns, broadcasts, social platforms, etc, can enhance awareness of using smart prepaid meters.

to consumers. This will help at the time of on-boarding and gain the trust of consumers quickly. Spending just five minutes with consumers in explaining these aspects can save significant post roll-out operational challenges.

Balanced man-machine interface requirement

Consumer trust improves when the system offers a proper trade-off between:

- **Online interactions** (app/ dashboard, backend alerts, customer portals).
- **Local interactions** (meter display + BLE access + on-ground support).

This approach ensures that consumers can still interact with the meter even when WAN is unavailable (ie, No-WAN) and gradually gain trust to use the online system.

While adopting such practices, the North Bihar utility could touch the installation milestone of around ~5,000 meters per day in a project.

3.3. Phase C – Post-installation: Value realisation → Habit building → Sustained adoption

Post-installation is where AMI becomes a living consumer system. The goal is to convert the AMI into a trusted daily-use tool rather than just a passive device.

Transition from non-smart meters

Addressing challenges during the post-installation phase of smart prepay meters involves implementing a seamless integration of systems to transition from old non-smart post-paid meters. This includes ensuring seamless integration between existing utility infrastructure and new smart meter systems, minimising disruption, and maximising efficiency in managing consumer accounting, old outstanding, and energy usage data. Before physically installing smart meters on field, significant efforts and due diligence must be put in place by both, utilities and AMISPs, to ensure all existing utility systems and new smart metering systems can handle this transition smoothly and efficiently. This apart, systems and processes must be kept agile to quickly adopt the roll-out learnings and improvise on them.

Digital support

An integration with multiple payment gateways having a guest recharge or payment option, interactive mobile application, and strong grievance resolution can build user confidence. In North Bihar, about 90 percent users shifted to app-based recharge.

Technical backbone for 'No-WAN' reliability

For sustained adoption, the system must support continuity even without WAN:

- BLE/local access should allow consumption or balance updates and diagnostics.
- Ensuring that communication disruptions do not break consumer trust.

Continuous reinforcement

Engagement through multiple communication channels such as consumption tracking in both monetary and half-hourly usage patterns, real-time consumer-critical alerts (eg, overload, low balance), and accessible toll-free support enhances user confidence, reinforces informed usage behaviour, and supports sustained adoption.

Billing resolution

Both the utility and AMISP agencies must launch targeted campaigns and doorstep services to address consumers' billing-related concerns. With such one-on-one interaction, they can resolve issues swiftly and ensure accurate billing. These campaigns are a great way to build customer satisfaction.

Transparency and fairness

When consumers consistently see accurate balance and consumption, they perceive the system as fair. This reduces disputes and strengthens payment discipline.

Measured outcomes

In North Bihar, ~3 million online recharges per month and ~21 percent debt recovery improvement was achieved, linked to adoption and transparency.

4. Tariff Innovation Enabled by AMI

4.1. Prepaid as foundational innovation

Prepaid offers pay-as-you-go control, reduces bill shock[4], and becomes an empowerment tool when supported by transparent interfaces.

A prepaid mechanism inside the meter can be a key enabler and trust builder in a critical scenario

like in 'No-WAN'. When balance, deduction logic, and energy accounting are robustly maintained inside the meter and immediately available on mobile application without any remote dependency, then consumers find this system as more trustworthy and robust. Utilities can prevent revenue leakage even during remote communication disruption, while consumers receive reliable usage and balance visibility.

4.2. Simplified tariff structures

Rather than exposing consumers to complex tariffs, a simplified visible tariff (energy charge + single tax) can be presented. Such a simplified version is easy to handle at both ends of consumers and utilities.

This can be further strengthened if tariff rules and ledger logic are embedded (or securely synchronised), so consumers see consistent deductions and balance even when WAN is intermittent.

4.3. Readiness for TOU tariffs

AMI supports TOU tariffs, but adoption depends on clarity[5][6]. Consumers must:

- Understand peak/off-peak periods.
- Receive alerts, and more.

The same engagement + interface framework used for prepaid adoption can transition consumers to TOU with minimal resistance.

4.4. Protecting consumers

AMI supports:

- Emergency credit.
- Low-balance alerts.
- Targeted subsidy delivery.
- Marking critical consumers as privileged.

These features improve acceptance of advanced tariff models.

4.5. Debt recovery and tariff transition: Engagement → Transparency → Innovation

High debt has become critical for utilities to recover but leveraging the advantage of technology and innovation along with social engineering, North Bihar has overcome this challenge, and it has become a great learning model for all others. Through implementation of EMI-based debt recovery, mechanisms like recovering the debt in easy and equal instalments for 300 days or one year can be major breakthrough. Also, flexibility in repaying the debt, ie, easy option for payment against either recharge or debt recovery similar to home loan repayment flexibility will enable consumers to pay debt in a more effective and participative way – a win-win approach for both consumers and utilities.

5. Applications Across Contexts

This blueprint can be adopted for:

- Large-scale deployments with mixed digital literacy.
- Smart metering in trust-deficient markets.
- Introducing TOU/dynamic pricing.
- Debt recovery through transparent EMI-based models.
- Customer satisfaction programmes focused on transparency.

6. North Bihar Deployment Outcomes

~90% online recharge adoption

~5,000 meters/day installation productivity

~3 million online recharges/month

~21% debt recovery

7. Conclusion

Large-scale AMI rollouts should not be treated merely as technology deployments, but as structured consumer adoption and revenue transformation programmes. The North Bihar experience demonstrates that when smart prepayment, tariff reform, and consumer engagement are integrated into a single operational blueprint, measurable financial and behavioural outcomes follow. Reliable fall-back mechanisms such as BLE for 'No-WAN' scenarios, embedded prepaid intelligence within the meter, and a balanced man-machine interface convert apprehension into participation.

The results – high digital recharge adoption, improved installation productivity, significant debt recovery improvement, and readiness for tariff innovations such as TOU – highlight that trust and transparency are not soft concepts; they are revenue enablers.

From this paper, we can get an inference through a three-phases approach that technology must be consumer-centric, resilient, and implementation-ready. When designed around fairness, continuity, and clarity, AMI becomes more than infrastructure – it becomes a scalable reform instrument for financial sustainability, tariff modernisation, and long-term grid transformation.

8. Bibliography

[1] Ministry of Power, Government of India, Revamped Distribution Sector Scheme (RDSS) Guidelines, New Delhi, India, 2021.
[2] International Energy Agency (IEA), Digitalization and Energy, Paris, France: IEA Publications, 2017.
[3] Central Electricity Authority (CEA), Technical Standards for Communication System in Power System Operations, New Delhi, India, 2020.
[4] World Bank, Prepaid Electricity Metering: An Assessment of its Impact on Revenue Collection and Consumer Behavior, Washington, DC, USA, 2014.
[5] Ofgem, Smart Metering Implementation Programme: Consumer Engagement and Time-of-Use Tariffs, London, U.K., 2018.
[6] Bihar Electricity Regulatory Commission, FY2024-25.

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