



Report on
***Roadmap for Implementation of Smart Domestic PNG
(DPNG) Metering Across India***



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Executive Summary

The Petroleum and Natural Gas Regulatory Board (PNGRB), in furtherance of its mandate to enhance transparency, efficiency, safety, and technological advancement in the City Gas Distribution (CGD) sector, constituted an Industry Committee to develop a comprehensive roadmap for the nationwide implementation of Smart Domestic PNG (DPNG) meters. The Committee was tasked with examining available smart metering technologies, evaluating their technical and economic feasibility, reviewing the existing regulatory framework, and recommending a structured and sustainable implementation strategy.

The Committee undertook a detailed comparative assessment of conventional diaphragm meters and smart domestic gas meters, including diaphragm, thermal mass flow, and ultrasonic technologies. In line with PNGRB Regulations, smart DPNG meters are characterized by two-way communication, prepaid functionality, and an in-built shut-off valve. The assessment established that smart meters offer significant advantages over conventional meters, including automated meter reading, real-time consumption monitoring, improved billing accuracy, enhanced safety through remote shut-off in case of leakage or tampering, real-time tamper alerts, and improved consumer transparency. From a commercial standpoint, prepaid smart metering and remote communication effectively eliminates bad debts, strengthens revenue protection, reduces operational expenditure, and improves cash flows for CGD entities.

Based on technical performance, lifecycle cost analysis, and implementation readiness, the Committee concluded that smart diaphragm-based domestic PNG meters presently offer the most feasible and cost-effective solution for large-scale deployment across the CGD sector. These meters combine proven diaphragm-based accuracy and reliability with smart functionalities, are compatible with existing CGD infrastructure, and benefit from an established domestic manufacturing ecosystem. While thermal mass flow and ultrasonic meters offer accuracy and fewer moving parts, their comparatively higher costs make them less suitable for initial nationwide rollout.

Extensive deliberations with CGD entities revealed persistent challenges under the conventional postpaid regime, including consumer payment defaults, accumulation of receivables, high recovery costs, and recurring expenditure on manual billing and meter reading. Industry data indicated that a significant proportion of domestic consumers default on payments, resulting in substantial financial and operational burden for CGD entities. The Committee observed that prepaid smart metering directly addresses these challenges and delivers tangible operational and financial benefits, making CGD entities the primary beneficiaries of smart DPNG meter implementation. Accordingly, the Committee is of the view that any additional expenditure associated with smart metering should not be passed on to consumers and may be borne by CGD entities.

The Committee examined various commercial models, including CAPEX+OPEX-based and TOTEX-based approaches, and noted that TOTEX models such as long-term managed service or leasing arrangements—can mitigate high upfront costs by spreading expenditure over the meter lifecycle, thereby accelerating adoption. Key implementation challenges identified include higher initial costs, recurring connectivity and backend system expenses, replacement

of existing conventional meters, lack of uniform communication protocols, and battery life optimization.

To address these challenges, the Committee recommended amendments to PNGRB Technical Standards and Specifications (T4S) Regulations to incorporate standards for smart meter functionalities, development of uniform data communication and cybersecurity protocols, and collaboration with BIS and NIC to ensure standardisation and interoperability respectively. A phased implementation plan has been proposed, mandating smart prepaid meters for all new domestic PNG connections and gradual replacement of existing meters over a defined timeline. The Committee also emphasized the need for enabling measures such as aggregated procurement, promotion of domestic manufacturing, TOTEX-based financing, viability gap funding, and production-linked incentives.

In conclusion, the Committee unanimously recognizes Smart DPNG metering as a transformative intervention for the CGD sector. With appropriate regulatory support, financial enablers, and a phased rollout strategy, smart domestic PNG metering can be implemented at scale, delivering long-term improvements in safety, efficiency, transparency, and consumer trust, and enabling a digitally resilient and consumer-centric natural gas distribution ecosystem in India.

1. Introduction

The Petroleum and Natural Gas Regulatory Board (PNGRB), in its continuous endeavour to promote technological advancement, consumer transparency, and operational efficiency within the City Gas Distribution (CGD) sector, has constituted an Industry Committee vide Order PNGRB/Tech/18-PNGMeterImpl./(6)/2025 dated 17.06.2025 to formulate a comprehensive roadmap for the implementation of Smart Domestic PNG (DPNG) Meters across India.

This initiative is aligned with PNGRB's overarching objective of enhancing consumer transparency & satisfaction through improved accuracy in metering and billing and advancing digital transformation within the downstream natural gas sector. The introduction of smart metering technology is envisaged to strengthen transparency, enable efficient monitoring and control, and facilitate an improved consumer experience through data-driven decision-making and automation.

The constitution of this Industry Committee reflects PNGRB's commitment to developing a structured and collaborative approach towards the nationwide deployment of smart metering solutions. The recommendations emerging from this exercise are expected to guide a uniform, efficient, and consumer-centric rollout of Smart Domestic PNG Meters across the country.

2. Constitution of the Committee

The Committee was constituted under the Chairmanship of **Shri Anjan Kumar Mishra, Secretary, PNGRB**, and comprised senior representatives from leading CGD entities, as detailed below:

S. No.	Name	Designation & Organisation	Position
1	Shri Anjan Kumar Mishra	Secretary, PNGRB	Chairman
2	Shri Manoj Jain	Managing Director, Torrent Gas Ltd.	Member
3	Shri Kamal Kishore Chatiwal	Managing Director, Indraprastha Gas Ltd.	Member
4	Shri Bhashit Dholakia	COO, Indian Oil Adani Gas Pvt. Ltd.	Member
5	Shri Gagan Aggarwal	Deputy Director I/C (Technical), PNGRB	Convener

As per PNGRB's Committee Constitution order, the Terms of Reference (ToR) of the Committee is as under:

- a. *To conduct a comparative assessment of Smart DPNG meters vis-à-vis conventional DPNG meters, including:*
 - i. *Accuracy, reliability, operational efficiency and safety features*
 - ii. *Lifecycle cost, including capital and operational expenditure*

- iii. Benefits in terms of customer experience and billing coverage etc.*
- b. To assess & propose financial models and strategies along with an implementation roadmap for deploying Smart DPNG meters across the CGD network.*
- c. To review the existing Regulatory framework, including technical standards related to meters for CGD network and make recommendations to enable smart metering in existing and new PNG connections in India.*

3. Committee Proceedings

The Kick-off Meeting of the above referred Committee was convened on **30.06.2025**, marking the formal commencement of deliberations on the implementation framework for Smart DPNG Meters. The discussions during the meeting encompassed several critical aspects, including:

- a. **Technical Architecture:** Detailed examination of the design and functionality of Smart DPNG Meters based on Advanced Metering Infrastructure (AMI) systems, with emphasis on scalability, reliability, and real-time data management.
- b. **Communication Technologies:** Evaluation of suitable communication options such as NB-IoT, LoRa, and GPRS, along with strategies for seamless data integration with existing billing and customer management systems.
- c. **Economic Assessment:** Review of cost-benefit considerations, lifecycle economics, and potential operational efficiencies achievable through smart metering deployment.
- d. **Data Governance:** Considerations related to consumer data privacy, cybersecurity safeguards, and interoperability standards to ensure secure and consistent information exchange across platforms.
- e. **Implementation Strategy:** Exploration of incentive mechanisms and financing models to facilitate large-scale and sustainable adoption of smart metering solutions within the CGD sector.

Following the Kick-off Meeting, the Committee recommended further deliberations with Smart Meter manufacturers to obtain first-hand insights into the available technologies and prevailing industry practices. Accordingly, a meeting with leading Smart Meter manufacturers was held on 15.07.2025. During the interaction, the manufacturers delivered detailed presentations on key parameters including meter type and design, manufacturing cost, accuracy, reliability, operational efficiency, and inherent safety features of their Smart Meter models. The session enabled substantive technical discussions and facilitated an assessment of the technological options suitable for DPNG applications.

Additionally, several manufacturers expressed interest in hosting plant visits for the Committee to provide deeper insight into their manufacturing processes and quality assurance systems. A brief on the classification and operating principles of domestic natural gas meters, along with a tabulated summary of technical particulars as furnished by the manufacturers, is presented in the ensuing sections of this report.

3.1 Classification, Operating Principles Specifications, and Comparison, of Domestic Natural Gas Meters

Domestic gas meters are critical components of City Gas Distribution (CGD) systems, ensuring accurate measurement of natural gas supplied to residential consumers. With advancements in metering technology, conventional mechanical meters are expected to be supplemented or replaced by smart meters incorporating electronic sensing and communication capabilities.

As per PNGRB Regulations, Smart Domestic PNG meters, having features for two-way communication, prepaid functionality, and an in-built shut-off valve, offer significant advantages over conventional meters. Remote communication enables automated meter reading and timely operational insights, while prepaid metering with in-built edge computing ensures real-time consumption management and eliminates billing inefficiencies. Enhanced safety is achieved through remote shut-off of gas supply in case of leaks, tampering, or low balance, complemented by real-time tamper alerts that improve consumer security. From a commercial perspective, smart DPNG meters eliminate bad debts, strengthen revenue protection, reduce operational costs, and improve cash flows for CGD entities.

The subsequent details provided below describe the construction and working principles of commonly used domestic gas meters.

3.1.1 Conventional Diaphragm Type Natural Gas Domestic Meter

The conventional diaphragm gas meter operates on the principle of positive displacement. Gas entering the meter alternately fills and empties flexible diaphragm chambers. The reciprocating motion of the diaphragms is transmitted through a crank and gear mechanism to a mechanical index, which registers the cumulative volume of gas passed through the meter. Each diaphragm cycle corresponds to a fixed and known volume of gas, ensuring reliable volumetric measurement.



Picture 1: Conventional Diaphragm Gas Meter

3.1.2 Smart Diaphragm Type Domestic Gas Meter

Smart diaphragm gas meters retain the same positive displacement measurement mechanism as conventional diaphragm meters. However, the mechanical movement of the diaphragm is detected using magnetic or optical sensors. The sensed signals are processed by an electronic module to calculate gas volume digitally. These meters support data logging, remote meter reading, tamper detection, and alarm functions while maintaining proven diaphragm-based accuracy.



Picture 2: Smart Diaphragm Gas Meter

3.1.3 Smart Thermal Mass Flow Domestic Gas Meter

Thermal mass flow gas meters measure gas flow based on heat transfer. A micro-heater introduces a known amount of heat into the gas stream, and temperature sensors positioned upstream and downstream measure the resulting temperature differential. This differential is directly related to the mass flow rate of the gas. The measured mass flow is electronically converted into volumetric flow under standard conditions.



Picture 3: Smart Thermal Mass Flow Gas Meter

3.1.4 Ultrasonic Smart Domestic Gas Meter

Ultrasonic gas meters operate on the transit-time principle. Ultrasonic transducers mounted across the gas flow path transmit and receive sound waves in both upstream and downstream directions. The difference in transit time is proportional to the gas flow velocity. Using the known internal cross-sectional area, the meter computes volumetric flow electronically.



Picture 4: Ultrasonic Smart Gas Meter

Each type of domestic gas meter has distinct constructional features and operating principles. Conventional diaphragm meters offer simplicity and robustness, while smart diaphragm, thermal mass flow, and ultrasonic meters provide enhanced functionality and suitability for automated metering systems.

Table-1: Comparison of Domestic PNG Meters based on technical parameters

S No.	Description	Conventional DPNG Meter (Diaphragm)	Smart DPNG Meters		
			Diaphragm	Thermal Mass Flow	Ultrasonic
1	Accuracy	Typically, accuracy class 1.5 per EN 1359 specified for diaphragm meters (i.e., max error $\pm 1.5\%$) under reference conditions.	Smart diaphragm meters improve, remote reading, data logging; though the base meter remains diaphragm with maximum permissible error (MPE) of $\pm 1.5\%$ under reference conditions.	Thermal-mass flow meters claim accuracy for gas metering with maximum permissible error (MEP) of 2% max error at high flow and $\sim 3.5\%$ at low flow	Ultrasonic meters that meet ANSI B109.6 are typically Class 1 signifying an accuracy of $\pm 1\%$ at room temperature. Some meters may achieve even higher accuracy such as $\pm 0.5\%$.
2	Reliability	Diaphragm meters are mechanically simple, widely	Smart diaphragm meters retain the mechanical diaphragm but	Thermal-mass flow meters have no moving parts (in many	Ultrasonic meters have no moving parts (in many

		deployed, mature technology; reliability is good, but moving parts and mechanical wear limit long-term stability and may require maintenance.	add electronics and communications; reliability improves for operations (remote reading, tamper detection) though still dependent on mechanical base meter life.	designs), which reduces wear and maintenance; they are “reliable but costly compared to conventional diaphragm meters and Smart Diaphragm meters	designs), which reduces wear and maintenance leading to long term stability. they are “accurate, reliable but costly compared to other meters.
3	Operational Efficiency	Manual reading of meters reduces the operation efficiency	a) Real Time monitoring of gas will help in improved gas reconciliation and reduce gas loss. b) Reduction in Bill payment defaults due to prepaid feature		
4	Safety features (Additional)	No provision of remote operated Shut-off valve	a) In-built Shut off Valve with Remote operation in case of gas leakage/theft etc. (over and above the conventional meters)		

During the meeting with Smart Meter manufacturers, the Committee examined the commercial and financial considerations related to the large-scale deployment of Smart Meters in the CGD sector. The manufacturers were requested to present the available financial models for the procurement, installation, operation, and maintenance of Smart Meters, including options for integration with customer billing systems. The interaction aimed to assess the range of feasible implementation frameworks—such as CAPEX, OPEX, and hybrid (TOTEX) models—that may be adopted by CGD entities. Pursuant to the Committee’s request, the manufacturers subsequently submitted detailed financial model documents to the PNGRB for further examination and analysis.

Table – 2: Model 1 (CAPEX + OPEX Model for Smart DPNG Meter)

S No.	Description	UoM	CAPEX + OPEX Model		
			Unit Rate excl. GST (in ₹) considering meter qty above 1 Lakh		
			Manufacturer A (Thermal mass flow)	Manufacturer B (Diaphragm)	Manufacturer C (Diaphragm)
CAPEX					
1	Supply of G1.6 Smart Meter with all required accessories	Per Meter	6200	4800	4,500
2	Installation, Testing and Commissioning	Per Meter	2125	150	150
3	Integration with CGD Entity's	Per Meter	25	No Charges if Manufacturers	10

	existing system (Payment gateway, SMS gateway & SAP system)			own Meter Data Management is used	
Total CAPEX (in ₹)		Per Meter	8,350	4,950	4,660
OPEX					
4	Cloud server hosting & Web Application charges	Per Meter Per Month	17	11	10
5	Communication charges	Per Meter Per Month	25	25	15
6	Operation and Maintenance of Cloud server & Web application	Per Meter Per Month	8	10	Included in head (4)
7	Operation and Maintenance of Smart pre-paid gas meters and all associated telemetry devices	Per Meter per Month	25	10	12
Total OPEX (in ₹)		Per Meter Per month	75	56	37

Table -3: Model 2 (TOTEX Model)

S No.	Description	UoM	TOTEX Model		Remarks
			Manufacturer A (Thermal mass flow)	Manufacturer B (Diaphragm)	
1	Supply, Installation, Testing, Commissioning, Integration with CGD Entity's existing system (Payment gateway, SMS gateway & SAP system), Cloud server hosting & Web Application charges, Communication charges, Operation and Maintenance of Cloud server, Web Application, Smart meter & all associated telemetry devices	Per Meter Per Month (for the period of 10 Years)	₹150–₹160	₹84–₹90	
2	Battery replacement cost (usually after 10yrs)	Per Meter	₹800 - ₹1000	₹800 - ₹1000	Battery replacement is required once in 10

					Years, if meter reading is fetched from the Smart meter once in a day.
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Note: The pricing mentioned in both models illustrated above does not includes the re-verification cost of meters which needs to be done in 7 years (for diaphragm Meters) and 6 years (for thermal mass flow meters).

Considering both the technical and economic aspects, the Committee is of the considered view that diaphragm based smart Domestic PNG meters, presently offer the most feasible and cost-effective solution for large-scale implementation across the City Gas Distribution (CGD) sector. Diaphragm-type smart meters combine proven metering accuracy, operational reliability, and compatibility with existing CGD infrastructure, while enabling integration of smart functionalities such as remote communication, prepaid operation, and safety shut-off mechanisms. From an economic standpoint, their relatively lower capital cost, established domestic manufacturing base, and ease of installation/maintenance make them well-suited for widespread adoption, particularly during the initial phases of smart metering rollout in the CGD sector.

3.2 Deliberation with City Gas Distribution (CGD) Entities

Following the two meetings referenced earlier, the Committee identified the need for direct engagement with City Gas Distribution (CGD) entities to obtain operational insights and consumer-management perspectives. Accordingly, an interactive meeting with CGD entities was convened on 05.08.2025. During the discussions, the entities collectively affirmed that Smart Metering is aligned with the future requirements of the CGD sector, particularly in advancing transparency, operational efficiency, and digitalisation.

The Committee noted inputs from entities operating in mature geographical areas, where a significant number of defaulting domestic PNG consumers have led to recurring year-on-year accumulation of recoverable dues. As a result, these entities continue to incur substantial expenditure on recovery-related activities. The CGD entities further highlighted that the full benefits of Smart Metering could be achieved only through a prepaid operating model, which would support improved cash-flow management and reduce billing-related disputes.

Some entities also informed the Committee of ongoing Smart Meter pilot projects within their respective authorised geographical areas and shared preliminary implementation experiences. It was additionally conveyed that the current cost of Smart Meters is considerably higher—approximately 5 to 9 times the cost of conventional diaphragm meters—thereby posing an economic challenge for large-scale deployment.

In light of the above deliberations, the Committee advised CGD entities to furnish comprehensive data on key parameters, including the number of defaulting consumers, average recoverable dues per consumer, costs incurred on recovery activities, and annual expenditure on manual billing operations. These parameters are expected to undergo significant reduction

with the introduction of Smart Metering. The consolidated data submitted by the entities is presented in the table below.

Table -4: Summary of Consumer Default and Associated Cost Parameters for Conventional PNG Meters

S No.	Description/Parameter	UoM	Industry Average (Approx.)
1	Percentage of Defaulting Consumers (in case of Conventional PNG Meters)	%	9% (range varying from 2% to 30%)
2	Average Payment outstanding per defaulting Consumer	(in ₹)	8,500
3	Cost to be incurred for Recovery/Temporary Disconnection/Permanent Disconnection per defaulting Customer	(in ₹)	2,700
4	Annual Cost incurred in Manual Billing (Per conventional PNG meter)	(in ₹)	220

In view of the above-mentioned parameters and the outcomes arising therefrom, it is evident that City Gas Distribution (CGD) entities emerge as the primary beneficiaries of Smart Domestic PNG metering. The implementation of smart metering yields significant operational, commercial, and financial advantages for CGD entities, including improved billing efficiency, enhanced revenue collection, reduction in operational expenditure, and pre-paid bill collection etc. Accordingly, the Committee is of the considered view that any additional expenditure incurred towards the deployment of Smart Domestic PNG metering should not be passed on to consumers and may be borne by the CGD entities.

3.3 Committee visit to Smart DPNG meter manufacturing facility

As part of its deliberations, the Industry Committee undertook a field visit to the IGL Genesis Smart Meter Manufacturing Facility at Noida, Uttar Pradesh on 18.09.2025 to gain first-hand insight into the production, assembly, and quality assurance processes of Smart Domestic PNG (DPNG) Meters. During the visit, the Committee observed the end-to-end manufacturing operations, including the assembly line, testing procedures, and two-stage calibration process adopted to ensure the highest levels of meter accuracy, reliability, and consistency. The two-stage calibration, comprising both primary and secondary verification using precision reference standards was noted as a critical quality control step that ensures each meter conforms to international metrological standards and maintains accuracy across its operational life. The Committee appreciated the systematic quality assurance framework implemented at the facility, which reflects the growing maturity and technological self-reliance of India's smart metering ecosystem.



4. Implementation Challenges and Way Forward -

4.1 Higher upfront CAPEX of Smart Meter vis-à-vis conventional meters:

Conventional G1.6 diaphragm meters retail roughly in the ₹ 800–₹1,000 range in India, whereas smart meters add electronics, communications, and a shut-off valve, raising unit CAPEX materially (exact prices vary by spec and tender). While smart meters do entail a higher upfront capital expenditure (CAPEX) compared to conventional G1.6 diaphragm meters, their adoption can be economically justified through a TOTEX (Total Expenditure) model, which considers both CAPEX and operating expenditure (OPEX) over the asset's lifecycle. Smart meters also significantly reduce operational costs by eliminating the need for manual meter reading and billing, enhancing accuracy, and minimizing revenue losses from unbilled or misread consumption. Additionally, features like remote shut-off valves and real-time data analytics help lower recoverable and improve cash flow by enabling quicker detection of tampering and non-payment. Over time, these cumulative OPEX savings and improved revenue assurance can offset the higher initial investment, making

smart meters a financially sound and future-ready alternative to conventional diaphragm meters.

4.2 Ongoing OPEX for connectivity and head-end systems:

Unlike mechanical meters, smart DPNG meters incur recurring costs for communications (NB-IoT/2G/LoRa WAN SIM or network charges) plus cloud/MDM hosting and support. Operators globally deploy NB-IoT/LPWAN for metering; NB-IoT is designed for low-power, wide-area utility telemetry, but still requires paid connectivity and backend operations.

While smart DPNG meters bring significant operational benefits, they also incur ongoing OPEX for connectivity (such as NB-IoT/2G/LoRa WAN SIM/network charges) and backend systems including cloud-based Meter Data Management (MDM) and head-end support. These recurring costs, though essential for real-time telemetry and remote operations, can add up across large deployments. To address this, a standardized, open communication protocol adopted uniformly across manufacturers and CGD entities can significantly reduce overall system integration and maintenance costs. Such standardization would enable interoperability, encourage vendor competition, and prevent vendor lock-in, driving down both device and backend expenses. In this regard, it is recommended that the Petroleum and Natural Gas Regulatory Board (PNGRB) collaborate with the National Informatics Centre (NIC) to develop and roll out a robust, open, and royalty-free protocol tailored for the DPNG sector. This coordinated effort can lay the foundation for cost-effective, scalable smart metering infrastructure across India.

4.3 Replacement of old conventional meters:

In all authorised Geographical Areas (Gas), replacing already-installed conventional meters is a herculean task. To address this, a phased implementation plan for the systematic replacement of old conventional meters with smart meters can be adopted. This structured approach enables capacity building, minimizes disruption, and ensures efficient resource allocation while steadily transitioning towards a smarter, digitally enabled gas distribution network.

4.4 Availability of Smart Meters:

The availability of smart meters is not anticipated to pose a constraint to implementation; however, manufacturing capacity remains an important consideration for planning purposes. At present, the annual manufacturing capacity for diaphragm-based Smart Domestic PNG meters is approximately 35 lakh units, while that for thermal mass flow-based smart meters is about 3 lakh units. Given that the number of new domestic PNG connections added annually is currently around 10 lakh, the existing manufacturing capacity is considered adequate to support the proposed rollout of Smart DPNG meters without any supply-side constraints.

4.5 Technical Standards & interoperability issues:

Technical Standards pertaining to Domestic PNG meters which are covered under PNGRB (Technical Standards and Specifications including Safety Standards for City or Local Natural Gas Distribution Networks) Regulations, 2008, are as listed below –

S No.	Type of Meter	Standards already covered in PNGRB T4S for CGD Regulations, 2008	Suggestions for Adoption in PNGRB T4S for CGD Regulations, 2008
1	Diaphragm Meter	<i>BS 1359 - Gas meters - Diaphragm gas meters</i>	a. <i>IS 14439 (Part -2) Legal metrology - Gas volume meters: Part 2 diaphragm gas meters</i> b. <i>EN 16314 Gas meters - Additional functionalities.</i> c. Common communication and data protocols.
2	Ultrasonic Meter	<i>BS EN 14236 - Ultrasonic domestic gas meters</i>	a. <i>EN 16314 Gas meters - Additional functionalities</i> can be adopted in PNGRB Regulations. b. Common communication and data protocols.
3	Thermal Mass Flow Meter	<i>EN 17526 - Gas meter- Thermal-mass flowmeter-based gas meter</i>	a. <i>IS 14439 (Part -4): 2025 Legal metrology -- Gas volume meters: Part 4 Thermal mass flow-based gas meters – Specification</i>, can be adopted. b. Common communication and data protocols.

Further, Smart meter manufacturers are complying with European Standards **EN 16314 Gas meters - Additional functionalities**, which includes additional requirements for domestic gas meter conforming to EN 1359 and EN 14236 having battery powered devices providing additional functionalities that form part of the gas meter or contained in an Additional Functionality Device (AFD). It also covers the additional requirements when an

electronic index is used rather than a mechanical one with an option of an integral valve to the meter.

However, no uniformity has been observed in standards w.r.t the communication protocol, amongst the manufacturers.

As of now, PNGRB T4S for CGD Regulations, 2008 does not include *EN 16314 Gas meters - Additional functionalities* and hence, needs to be included for standardisation of additional functionalities of gas meters across the sector. Simultaneously, PNGRB should actively collaborate with the Bureau of Indian Standards (BIS) to develop a dedicated Indian standard for Smart PNG Meters. This will provide regulatory clarity, promote uniformity across the ecosystem, and foster innovation while ensuring cost-efficiency and long-term scalability for city gas distribution entities.

4.6 Battery life vs. data transmission frequency:

Datasheets for leading smart gas meters/modules indicate 8-10 years battery life under recommended transmit intervals and good signal strength; however, the frequency of data exchange and two-way communication further shortens life and raises maintenance cost of batteries.

To mitigate this, it is recommended to limit two-way communication to once within a 24-hour cycle, sufficient for daily consumption updates, remote configuration, and exception handling. This controlled communication approach ensures that the core functionality of smart meters is maintained without compromising battery efficiency. By optimizing the data exchange frequency, utilities can extend device life, reduce field maintenance visits, and lower the total cost of ownership, making smart metering more viable and sustainable for large-scale deployments.

4.7 Transition of Customers from Postpaid to Prepaid Smart Metering:

While the transition from postpaid to prepaid billing through the adoption of smart PNG meters may initially face resistance from customers due to changes in usage habits and perceived inconvenience, the long-term benefits significantly outweigh these concerns. Prepaid smart metering empowers consumers with accurate and transparent billing, eliminating disputes related to estimated or delayed bills. Customers gain real-time visibility into their natural gas consumption, enabling better budgeting and control over usage. The prepaid model also offers greater flexibility, allowing users to recharge as per their convenience, much like prepaid mobile services. Additionally, it addresses common issues such as meter reading challenges in locked households and reduces interference from CGD personnel, as data collection and account management are handled remotely. Over time, this shift will lead to enhanced customer satisfaction, improved service reliability, and stronger trust in the billing process.

5. Recommendations

5.1 Regulatory Enablement:

- 5.1.1 To enable a smooth and standardized rollout of smart metering across the city gas distribution (CGD) sector, it is essential to amend the existing CGD T4S Regulations to explicitly incorporate technical, performance, and interoperability standards for smart PNG meters and existing CGD Authorisation Regulations to modify the cost associated with Smart PNG meters.
- 5.1.2 **In PNGRB T4S for CGD Regulations, 2008, EN 16314 Gas meters - Additional functionalities** needs to be included for standardisation of additional functionalities of gas meters across the sector, also, basic requirements of a Smart Domestic PNG meter as specified in PNGRB CGD Authorisation Regulations, must also be incorporated in PNGRB T4S for CGD regulations, 2008.
- 5.1.3 Further, clear guidelines on communication protocols and data security should also be formulated to ensure uniform adoption of Smart meters across the CGD sector. In parallel, the PNGRB should actively engage with the Bureau of Indian Standards (BIS) to expedite the development and notification of a dedicated Indian Standard for Smart PNG Meters (Diaphragm, Thermal mass flow, Ultrasonic). A distinct standard will not only align with international best practices but also promote domestic manufacturing, support regulatory compliance, and prevent vendor lock-in—laying the foundation for a robust and future-ready smart gas metering ecosystem in India.
- 5.1.4 In PNGRB Authorisation of CGD Regulations, 2008, the interest-free refundable security deposit of Rs. 9000/- for Domestic PNG Connection having Smart DPNG meter, should be reviewed and rationalised to facilitate its affordability and reduce the friction from consumers w.r.t installation of Smart Domestic PNG meters.

5.2 Interoperability including data communication protocols:

As smart metering infrastructure becomes integral to the CGD sector, ensuring robust data protection, remote access control, and cyber resilience is critical to safeguard consumer information and maintain operational security. To address these concerns, it is recommended that comprehensive guidelines be developed for cybersecurity across the smart metering ecosystem, covering aspects such as encrypted data transmission, secure authentication, and role-based access controls. Additionally, to enable seamless integration and interoperability across devices and platforms, PNGRB may coordinate with the National Informatics Centre (NIC) for the development of a common, secure communication protocol for smart meter data exchange and management. The

standardized smart meter and common protocol will serve as a unified framework for all CGD entities and meter manufacturers, ensuring consistency, reducing integration costs, and enhancing overall system resilience against cyber threats.

5.3 Phased Implementation Plan for implantation of Smart Metering in New as well already installed PNG connections:

5.3.1 Implementation of Smart meters in new connections: To standardize adoption and avoid future retrofitting costs, the Committee recommends that six months after Notification of relevant changes/amendment in T4S Regulations, all new domestic PNG connections must be equipped with prepaid smart meters, ensuring consumers benefit from advanced features like real-time consumption monitoring and accurate billing from the outset.

5.3.2 Already installed conventional meters: To ensure a smooth transition to smart metering in the CGD sector, the Committee recommends a four-phase rollout plan for the replacement of existing conventional meters. Also, Committee is of the view that priority of meter replacement may be given to the billed connections in first two phases, as depicted below -

S No.	Details	Implementation Plan for replacement of Conventional DPNG meters
1	Phase I (FY 26-27)	5% of billed connections
2	Phase II (FY 27-28)	15 % of billed connections
3	Phase III (FY 28-29)	25% of total connections
4	Phase IV (FY 29-30)	Remaining total connections

Note: All DPNG meter post 01 April 2030 should be Smart meters only.

This structured approach enables capacity building, minimizes disruption, and ensures efficient resource allocation while steadily transitioning towards a smarter, digitally enabled gas distribution network.

5.4 Financial Support Mechanisms:

5.4.1 Bulk Procurement to Reduce Upfront Costs

- Industry associations should take the lead in coordinating bulk procurement and demand aggregation of smart PNG meters.
- Aggregated demand is expected to generate economies of scale, thereby reducing per-unit costs and enhancing affordability for CGD entities.

5.4.2 Promotion of Localized Manufacturing

- Industry Associations should promote the localization of smart meter manufacturing in alignment with the Government’s *Make in India* initiative.
- Local manufacturing will help lower production costs and strengthen supply chain resilience.

5.4.3 Exploration of TOTEX-Based Financing Models

- In situations where high capital expenditure poses a challenge, the TOTEX model of financing should be explored.
- Under this model, CGD entities may engage with meter manufacturers or solution providers to adopt leasing or subscription-based arrangements.
- This approach enables deployment of smart meters with minimal upfront investment, distributing costs over the asset lifecycle while retaining operational and customer-service benefits.

5.4.4 Viability Gap Funding (VGF)

- Government may explore the provision of Viability Gap Funding (VGF) to support the financial feasibility of large-scale smart meter deployment by City Gas Distribution entities.
- Production Linked Incentive (PLI) Scheme may also be explored by the Government to incentivise manufacturers of Smart PNG meter for making smart meters affordable and easing the adoption of the same.

6. Conclusion

The Industry Committee concludes that the implementation of Smart Domestic PNG (DPNG) metering represents a critical and forward-looking reform for the City Gas Distribution (CGD) sector in India. The transition from conventional metering to smart metering is essential to address long-standing challenges related to billing inefficiencies, consumer defaults, operational costs, safety risks, and limited visibility into consumption and network performance.

Based on a comprehensive technical and economic assessment of available metering technologies, the Committee finds that smart diaphragm-based domestic PNG meters presently offer the most suitable balance of accuracy, reliability, cost-effectiveness, and compatibility with existing CGD infrastructure. These meters enable key smart functionalities such as two-way communication, prepaid operation, real-time data availability, tamper detection, and remote shut-off—while leveraging a mature and well-established domestic manufacturing ecosystem. Their adoption, particularly during the initial phases of nationwide rollout, is therefore considered both practical and economically prudent.

The Committee’s deliberations with CGD entities and analysis of industry data clearly establish that CGD entities are the primary beneficiaries of Smart DPNG metering. The adoption of

smart prepaid meters directly addresses issues of bad debts, high recovery costs, and manual billing expenditure, while significantly improving cash flows, revenue protection, and operational efficiency. In view of these benefits, the Committee is of the considered view that any additional cost associated with smart metering implementation should not be passed on to consumers and may appropriately be borne by CGD entities.

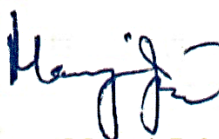
The Committee acknowledges that large-scale deployment of smart meters entails certain challenges, including higher upfront capital costs, recurring connectivity and backend system expenses, replacement of existing conventional meters, standardisation of communication protocols, and optimisation of battery life. However, these challenges are manageable through a combination of regulatory enablement, adoption of TOTEX-based commercial models, aggregated procurement, promotion of domestic manufacturing, and phased implementation. The Committee's recommended four-phase replacement plan and mandatory installation of smart meters in new connections provide a realistic and structured pathway for sector-wide transition.

Crucially, the Committee underscores the need for timely regulatory amendments to incorporate standards w.r.t smart meter functionalities within PNGRB's Technical Standards and Specifications, development of uniform communication and cybersecurity protocols, and collaboration with NIC to ensure interoperability and long-term scalability. Complementary policy support mechanisms, such as viability gap funding, concessional financing, and production-linked incentives will further accelerate adoption, particularly during the initial rollout phase.

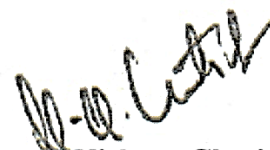
In conclusion, the Committee unanimously recognizes Smart DPNG metering as a transformative enabler for a safer, more transparent, digitally resilient, and consumer-centric CGD ecosystem. With coordinated action by Regulators, CGD entities, industry associations, and manufacturers, Smart Domestic PNG metering can be implemented at national scale, delivering enduring benefits to consumers, operators, and the natural gas sector as a whole.



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