



L&T SEMICONDUCTOR TECHNOLOGIES LIMITED

# Smart Meter Design

Considerations for Long-Life  
IoT Deployments

*A Global Market Whitepaper*  
**February 2026**

*Future. Made Together.*



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# 1. Executive Summary

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Smart meters are foundational to modern utility infrastructure, enabling accurate measurement, operational visibility, and data-driven optimization across electricity, gas, and water networks. For battery-powered meters expected to operate unattended for 10–20 years, engineering precision in design reliability and low power operation is non-negotiable.

Even marginal inefficiencies in power consumption, connectivity design, or module integration can materially reduce operational lifetime, increase field failures, and elevate total cost of ownership (TCO).

This paper outlines the critical engineering and architectural considerations required to design reliable, secure, and future-proof IoT smart meters at scale. It further demonstrates how compact, low-power cellular connectivity modules such as the LTSCT LCC40 enable utilities and OEMs to meet these stringent requirements with confidence.

## 2. Smart Metering Solutions Enabled by IoT



IoT-enabled smart meters convert raw consumption data into actionable intelligence by securely connecting field devices to cloud platforms and analytics engines.

**This enables utilities to:**



Deliver accurate billing and real-time usage transparency



Detect leaks, theft, and outages at an early stage



Improve demand forecasting and load balancing



Reduce operational expenditure through remote monitoring and OTA updates

Beyond metering, IoT connectivity is a strategic enabler for smart grids, sustainable infrastructure, and city-scale digital transformation initiatives.

# 3. Optimizing Utility Distribution with Smart Metering

Smart meters address long-standing operational challenges across utility domains:



### Electricity:

Load monitoring, outage detection, demand response



### Gas:

Safety monitoring, leak detection, consumption analytics

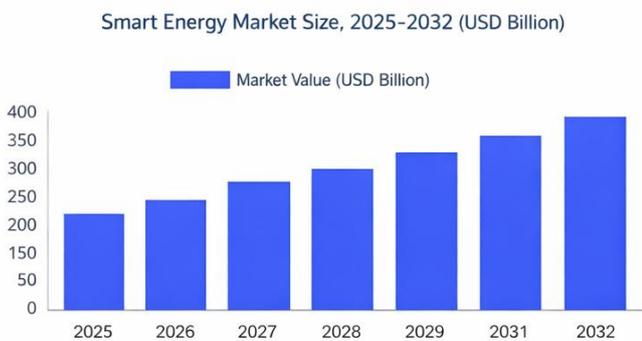


### Water:

Non-revenue water reduction, leak identification, usage optimization

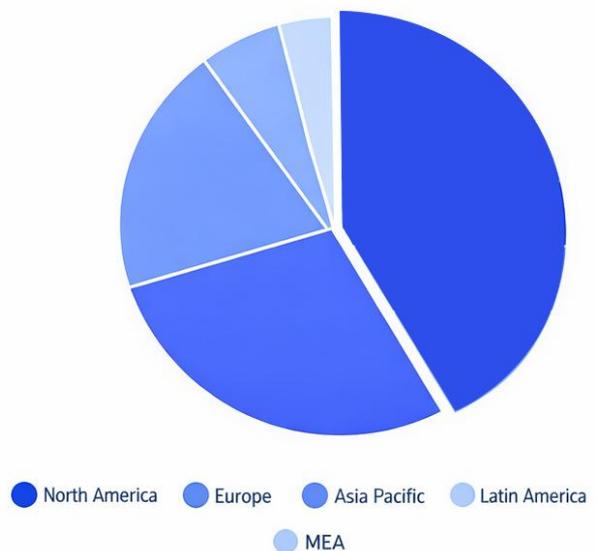
Near-real-time and periodic data collection improves network planning while empowering consumers with meaningful usage insights.

## Smart Energy Market Trends



\*Source: [www.databridgemarketresearch.com/reports/global-smart-utilities-market](http://www.databridgemarketresearch.com/reports/global-smart-utilities-market)

Smart Energy Market Share by Region, 2024 (Total Value - USD 52.29 Billion)



# 4. Core Engineering Factors in Smart Meter Design

## 4.1 Technology Longevity

Smart meters are long-life infrastructure assets. Connectivity technologies must remain commercially supported and interoperable for more than a decade.

Cellular LPWA technologies such as LTE-M and NB-IoT, originally introduced within 4G LTE, are now incorporated into 5G under 3GPP Release 17 as part of massive machine-type communications (mMTC). LCC40 based on LTE CAT 1 technology is ideal for moderate data rate applications compared to NB-IoT or LTE-M technologies simply because it supports the use of existing LTE infrastructure, seamless handover and roaming, higher throughput.



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## 4.2 Security

Smart meters process sensitive customer and operational data, making security a primary design requirement rather than an afterthought. Regulatory frameworks such as the EU Cyber Resilience Act (CRA) further increase compliance obligations across device lifecycles.



### Best practices include:

- Selecting trusted silicon and module vendors.
- Implementing secure boot, hardware root of trust, and encrypted communications.
- Ensuring compliance with region-specific regulatory and infrastructure requirements.

In distributed IoT systems, security is only as strong as the weakest component and robust, end-to-end design is essential.

## 4.3 Smart Meter Connectivity

Cellular connectivity offers near-global coverage, unlike unlicensed technologies constrained by regional spectrum regulations.

### LTE-M and NB-IoT:

Ideal for battery-powered gas and water meters

### LTE Cat 1 bis:

A globally deployable option for electricity meters or regions without LPWA coverage

### Fallback options:

Non-terrestrial networks (NTNs) extend reach to remote or underserved locations

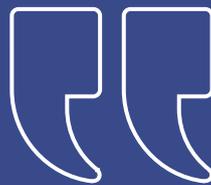
### Typical data-rate requirements:

#### NB-IoT:

>100 kbps

#### LTE-M:

Several hundred kbps up to ~1 Mbps



Selecting the right access technology ensures optimal balance between coverage, power efficiency, and lifecycle cost.

## 4.4 Power Consumption

Power efficiency is the defining constraint for battery-powered smart meters.

### Key design strategies include:

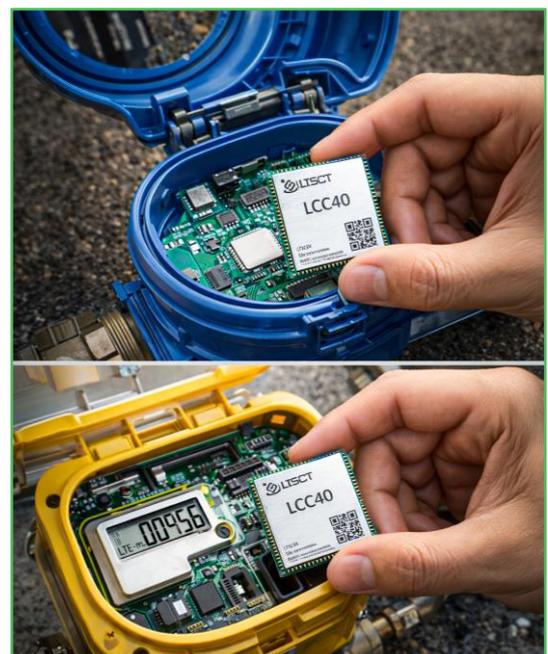
- Selecting modules with ultra-low deep-sleep current.
- Leveraging Power Saving Mode (PSM) and extended Discontinuous Reception (eDRX).
- Validating vendor specifications against real-world, lab-measured power profiles.

While cellular standards are uniform, vendor implementations vary significantly, leading to measurable differences in long-term battery life.

## 4.5 Module Size and Integration

Gas and water meters are mechanically constrained, high-volume products. Communication modules must integrate seamlessly without forcing enclosure redesigns or manufacturing process changes.

A compact form factor simplifies integration, reduces BOM risk, and accelerates time-to-market.



## 4.6 Coverage and Penetration

Meters are frequently deployed in challenging RF environments—basements, underground vaults, dense urban interiors, or remote rural areas.

- NB-IoT and LTE-M provide enhanced penetration compared to traditional 4G
- Coverage should be validated using network maps, simulations, and field trials
- NTN offers resilience where terrestrial coverage is unavailable

## 4.7 Latency Tolerance

Smart metering applications typically tolerate higher latency, enabling aggressive power-saving strategies.

### PSM:

Maximizes battery life but limits device reachability between reporting intervals.

### eDRX:

Balances energy efficiency with acceptable responsiveness.

Greater latency tolerance directly translates into longer operational lifetime.



## 5. Why Precision Engineering Matters

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In ultra-low-power designs, every microamp counts. Over a 10–20-year lifespan, even minor reductions in idle current can significantly extend battery life, reduce maintenance visits, and improve service reliability.

Achieving this requires a careful balance between hardware capability, connectivity selection, reporting cadence, and security implementation.

## 6. Enabling Smart Meter Design with the LTSCT LCC40 Connectivity Module

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The LCC40 is an LTE Cat 1bis IoT module designed for M2M and IoT applications, compliant with 3GPP Release 14 standards. With its compact form factor and robust performance, the LCC40 supports data rates of up to 10 Mbps downlink and 5 Mbps uplink, and offers optional integrated GNSS for precise location tracking.



Equipped with a rich set of internet protocols, standard interfaces, and wide OS compatibility, including Windows and Linux, these modules enable seamless connectivity for asset management, telematics, payments, smart metering, and automation. LCC40 is the ideal LTE upgrade for transitioning from legacy 2G/3G networks to efficient, future-ready IoT solutions is purpose-built to meet the demanding requirements of large-scale smart metering deployments:

- Ultra-low power operation optimized for long-life battery-powered gas and water meters.
- Support for LTE-M and NB-IoT, enabling global LPWA connectivity.
- Compact footprint tailored for space-constrained meter enclosures.
- Enhanced coverage performance for indoor, underground, and remote installations.
- Secure design foundation supporting regulatory compliance and long-term data protection.



By combining low power consumption, global connectivity, and a small form factor, **LCC40** enables utilities and OEMs to deploy smart meters that meet longevity, reliability, and security expectations at scale.

## 7. Application Scope:



**LCC40** connectivity modules are designed for use across a wide range of utility and infrastructure applications, including:



**Smart electricity meters**



**Water meters**



**Gas meters**



**Other utility and infrastructure monitoring devices**

In ultra-low-power designs, every microamp counts. Over a 10–20-year lifespan, even minor reductions in idle current can significantly extend battery life, reduce maintenance visits, and improve service reliability.

## 8. Key Takeaways

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- Smart meters must be engineered for reliable operation over decades.
- Connectivity, power management, and physical integration are decisive design factors.
- Coverage and latency trade-offs directly influence battery life and field performance.
- Compact, low-power cellular modules like **LCC40** simplify integration while ensuring long-term viability.

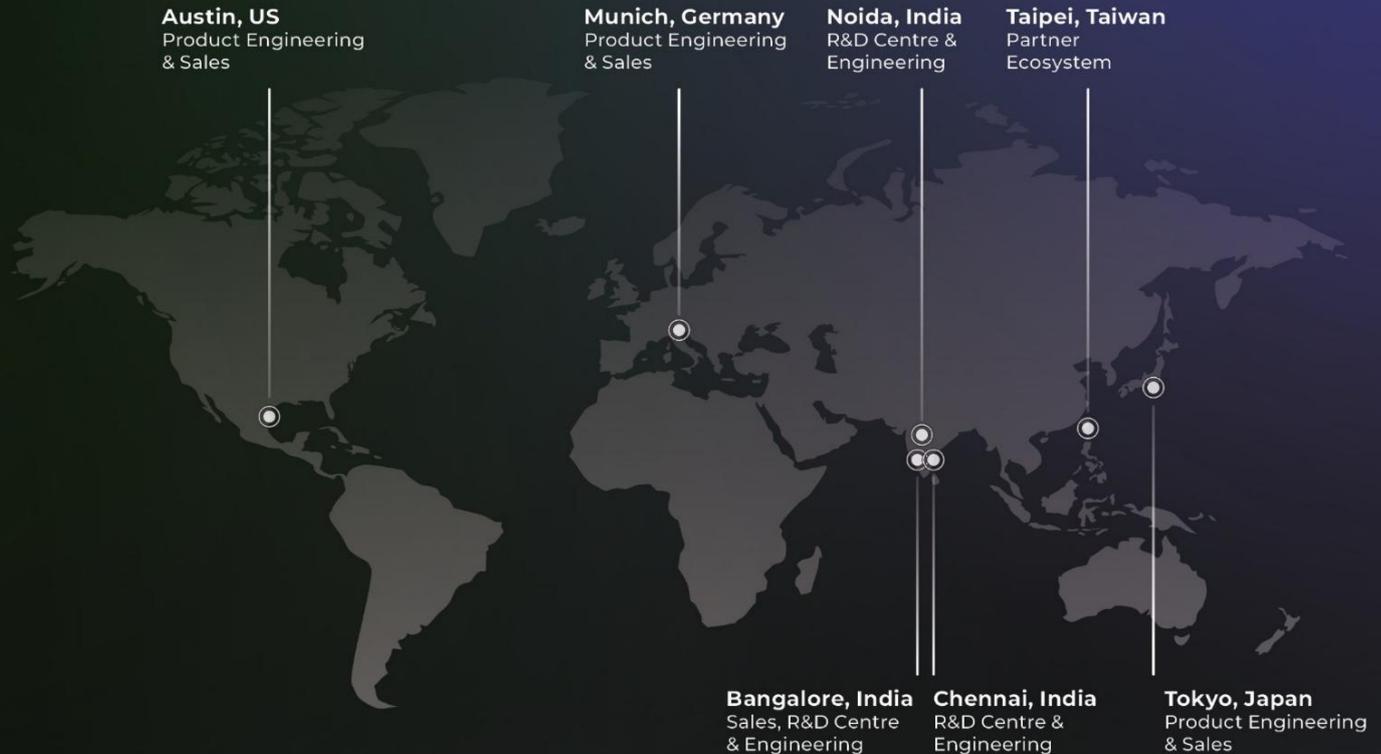
## 9. Conclusion

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Smart metering has evolved beyond measurement it is now a strategic enabler for intelligent, resilient utility operations. By combining disciplined engineering practices with proven cellular LPWA technologies and compact, low-power connectivity modules such as the LTSCCT LCC40, utilities and OEMs can deploy smart meters that remain secure, reliable, and cost-effective throughout their entire lifecycle.

# Our global footprint

LTSCCT operates on a global scale with strategic locations in Asia, Europe, and North America. This footprint allows us to stay close to our customers, enabling rapid support, localized production, and seamless logistics.



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Ready to shape the future together?  
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