




**Smart metering
– The connectivity state of affairs**

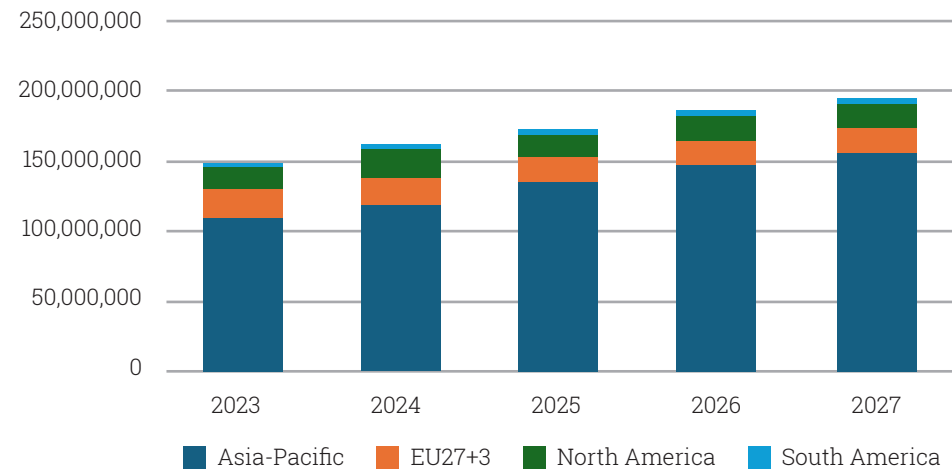
The background of the page features a dark, monochromatic image of several smart meters. The meters are arranged in a row, with the central one being the most prominent. Each meter has a digital display showing the number '03598' and a barcode below it. The meters are overlaid with a complex network of white lines and dots, representing a data network or smart grid. The overall aesthetic is technical and futuristic.

The electricity sector is in a permanent state of gradual transformation. A feature of today's transformation has been the increased share of renewable (non-plannable) electricity in the energy mix. According to Enerdata, the share of renewables in the power mix worldwide has increased by 10 percent since 2010 to around 30 percent by 2023. Terms like micro-generation, electric vehicles and prosumers (individuals who produce and consume electricity) define a new reality where traditional utilities must update their strategies to meet the challenges of tomorrow. Smart meters, despite their two-decade tenure, remain pivotal for future smart grids. The feature that puts the smart in smart meter is mainly connectivity. Notably, cellular connectivity has emerged as the go-to communications option for utilities, writes Mattias Carlsson, an IoT Analyst at the IoT market research firm Berg Insight.

Between 2019 and 2023, the penetration of smart electricity meters in Europe rose from 50 percent to 60 percent. The corresponding growth in Canada and the US was from 65 percent to close to 80 percent. By 2027, Berg Insight forecasts that the smart meter penetration rate will exceed 76 percent and 90 percent respectively in Europe and North America. In the Asia-Pacific region, East Asian countries are at the forefront of smart electricity metering adoption with China and Japan now having completed their nationwide rollouts. Meanwhile, the Indian market is set for massive growth in the years ahead as the country ambitiously aims to replace 250 million conventional electricity meters with smart prepaid meters in the coming years.

The adoption of smart metering solutions in the gas and water segments is lagging in comparison to the electricity sector. Countries such as Italy, the UK and France have led the adoption of smart gas metering in Europe and combined boast an installed base of around 47 million smart gas meters, translating to a market share of 84 percent. Outside of Europe, the market for smart gas meters is growing particularly strong in countries such as China and Japan. The smart water metering market is in an even earlier phase of adoption but is poised for significant growth as utilities continue to upgrade existing infrastructure and implement smart water solutions as a tool to become more sustainable and reduce non-revenue-water.

Figure 1: Yearly smart electricity shipment volumes (World 2023–2027)



The status of smart metering in Europe

In terms of market drivers for smart metering adoption, Europe stands out from a global perspective through its history of implementing top-down cross-border smart metering policies. Although EU regulations encourage the adoption of smart metering technology, deployment statuses for the European countries vary greatly as national governments ultimately decide whether to adopt the technology.

Countries such as Sweden and Italy had, for example, completed their smart meter rollouts before the concept of cost-benefit analysis (CBA) was even adopted. By the end of the last decade, countries such as Finland, Estonia, Malta, Luxembourg, Norway and Spain had also completed nationwide rollouts.

Second-wave installations are now to a large extent either underway or completed in the first-mover markets as the deployed systems have reached their end-of-life. In Italy, Enel has paved the way and had by the end of 2022 installed more than 25 million second-generation meters. Among the Nordic countries, Sweden is leading the rollout of second-generation meters and constituted one of the larger markets in terms of smart meter shipment volumes in 2023.

Large-scale first-wave rollouts are furthermore currently ongoing in a number of other major European countries, including the UK, the Netherlands, Ireland, Belgium and Lithuania. A market that is expected to finally take-off after a multiple-year delay is Greece, which plans to roll-out more than 7 million smart meters out of which 3.1 million are aimed to be deployed by 2026.

Navigating the shift in the North American market

Whereas the European market boasts roughly 310 million electricity customers, the North American market comprises a total of around 180 million electricity customers. The region has been at the forefront of smart grid technology adoption and has more than 140 million smart electricity meters installed. While large-scale rollouts had already started to emerge across North America in the mid-2000s, the market experienced a major boost during 2009–2013 through the American Recovery and Reinvestment Act.

Adoption has since then progressed at a slow but steady pace and is today mainly driven by legislation at the state or province-level, largely unaffected by competitive market forces. The investor-owned utilities (IOUs) that dominate the electricity sector are subordinate to state regulatory commissions authorised to veto any investment deemed too costly for end-customers.

While some states have consistently criticised the benefits of large-scale smart meter rollouts in proportion to the implementation cost, others have actively promoted smart meter deployments and adopted progressive policies for a green technology transition. As a result, there are significant differences in terms of smart meter adoption across various states.

East Asia’s ambitious national rollout strategies lead the way in Asia-Pacific

Asia-Pacific constitutes the world’s largest and fastest growing meter market, having an estimated installed base of more than one billion electricity metering devices.

More than a decade ago, South Korea and China launched national policies for their government-owned national utilities to complete the construction of nationwide smart grids by the year 2020. The latter completed its unprecedented rollout in 2018 after having installed a total of more than 550 million smart meters. In addition, second-wave rollouts have already been initiated due to the roughly 7-year life span of Chinese metering equipment.

South Korea’s 23 million smart meter deployment has on the other hand been subject to a series of delays caused by a myriad of technical concerns and tendering process issues. Japan, on the other hand, set a target to reach full deployment of smart meters for its 86 million electricity customers by 2025 and the electricity distributors in the country are on their way to complete the rollouts according to schedule by the end of 2024.



India’s ambitious leap – 250 million smart meters on the horizon?

As the smart metering market in East Asia is maturing, attention is now shifting to India. The national government has identified smart grid technology to be a potential solution to fight operational losses. In 2018, the Ministry of Power stated the extraordinary target of reaching nation-wide coverage of smart prepayment meters for all 250 million electricity customers by 2025.

Large deployments of smart meters have been ongoing in the last few years, following a lengthy period of pilot projects. The poor financial shape of the state-owned utilities which dominate the market has moreover led the government to go for a business model where a separate government-owned entity aggregates demand from a number of utilities and subsequently procures meters in bulk.

At the end of 2023, close to 100 million smart meters had been contracted but only 8 million had been installed. Berg Insight believes that the 250 million milestone will be reached around the end of this decade.

Connecting the smart energy ecosystem

Today, three broad technology groups dominate the smart metering communications market – power-line communications (PLC), radio frequency (RF) and cellular technology. The technology choice varies broadly by region and country. In Europe, PLC technologies such as G3-PLC and PRIME today account for an estimated two thirds of all smart metering installations.

The vast majority of meters installed in North America are in contrast using proprietary sub-GHz mesh or point-to-point RF networking platforms. In countries such as Australia and New Zealand, cellular communications are instead favoured – mostly because the market-driven rollout mode characterising these two countries.

Smart metering is a complex enterprise

A smart metering rollout consists of four distinct stages: i) system design and sourcing, ii) rollout and integration, iii) implementation and operation and iv) customer education. A considerable part of the system design stage is dedicated to matching the best suited network technology to the project.

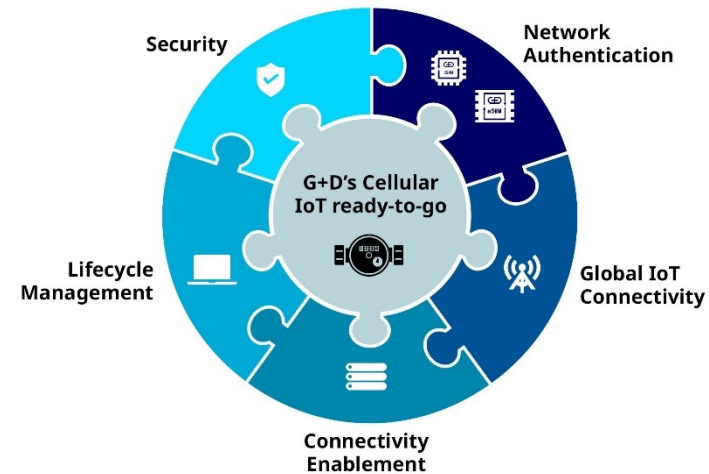
Smart metering is a cost sensitive, high-volume application that requires a small footprint networking technology. Gas and water meters in particular face stringent power consumption constraints as they rely on battery power. Network coverage is another critical aspect as many meters are situated in remote or hard-to-reach locations.

When it comes to cellular solutions, one of the first decisions is what standard to choose, for example NB-IoT, LTE-M or another 4G LTE variant. Further considerations have to be given to the selection of an IoT connectivity services provider, what type of SIM solution to use, and how the devices can be managed throughout their lifecycle.

Un-complexing smart metering with G+D's cellular IoT ready-to-go

Giesecke+Devrient (G+D), a leading company in eSIM development with a growing IoT connectivity business, aims to simplify connectivity for smart meter and utility customers in the electric, gas and water space. The main components of G+D's cellular IoT ready-to-go offering includes network authentication, IoT connectivity, connectivity enablement, lifecycle management and security.

Figure 2: G+D's Cellular IoT ready-to-go for utilities



- **Network authentication:** G+D's SIM solutions are tailored to address the diverse needs of IoT applications, providing various form factors and SIM generations, including iSIM, eSIM, and pSIM, along with hardware variations designed for specific applications, such as automotive, industrial and consumer use cases.
- **IoT connectivity:** G+D offers mobile connectivity as a service for a variety of IoT use cases, tailored for specific regions or used globally. The company covers 185 countries and cooperate with over 600 network operators. IoT data connectivity options encompass NB-IoT, LTE-M, LTE, 5G and satellite networks compliant with the 3GPP standards provide coverage in remote areas. The connectivity can also serve as a backup or function as global bootstrap connectivity (GBC) when the device is initially activated to load the final subscription at the device's location.
- **Connectivity enablement:** G+D's AirOn360 RSP platform empowers the digital connectivity journey with iSIM and eSIM management, which allows you to download your purchased iSIM/eSIM to your device and activate it. It is best-in-class and ensures the highest levels of availability as well as geo-redundancy. The company also offers solutions for various device categories that comply with both the latest and legacy RSP standards, including SGP.02 (M2M), SGP.32 (IoT), SGP.22 (Consumer) and SGP.42 (In-Factory Profile Provisioning).
- **Lifecycle management (LCM):** G+D's AirOn360 IoT Suite facilitates diverse applications for the remote management of IoT devices throughout their connectivity lifecycle. This includes functions like OTA campaign management, as well as applet administration. With their hybrid, multi-tenant management platform, IoT devices can be administrated individually or collectively as entire device fleets.
- **Security:** G+D's IoT security features protect data generated from cellular and non-cellular IoT devices, with its platform covering both the backend and SIM software. This enables mobile operators to offer a consolidated toolbox to OEMs and enterprises. They, in turn, are able to manage SIMs and other devices over the entire lifecycle – from manufacturing and activation, to managing subscriptions and policies, all the way to deactivation.

