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مركز الملك عبدالله للدراسات والبحوث البترولية
King Abdullah Petroleum Studies and Research Center

Beyond Smart Meters

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Instant Insight

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About KAPSARC

The King Abdullah Petroleum Studies and Research Center (KAPSARC) is a non-profit global institution dedicated to independent research into energy economics, policy, technology and the environment across all types of energy. KAPSARC's mandate is to advance the understanding of energy challenges and opportunities facing the world today and tomorrow, through unbiased, independent, and high-caliber research for the benefit of society. KAPSARC is located in Riyadh, Saudi Arabia.

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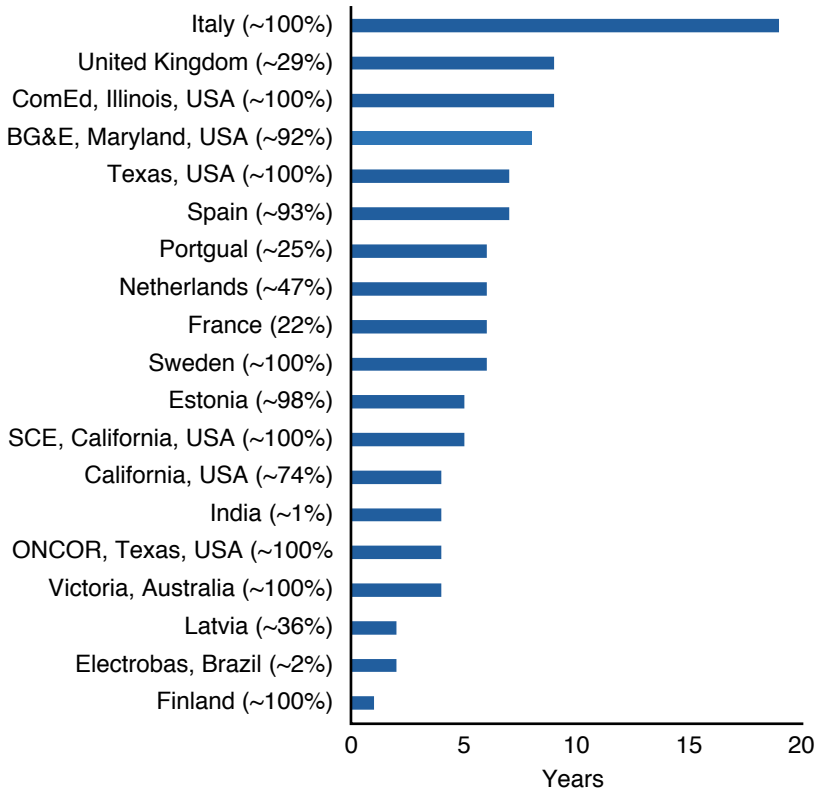
Over the last two decades, many countries have installed millions of smart meters to improve the efficiency, reliability, and quality of service in the electric power sector.

Compared with traditional meters, smart meters measure consumers' electricity usage at 5- or 15-minute intervals and communicate that usage and other data automatically to the utility. Both electricity consumers and their utility can benefit from smart meters. They provide more information to manage electricity consumption, improve power outage detection and restoration, enhance opportunities for additional value-added services such as billing options and time of use rates, lower the utility's costs, and enable distributed energy resources like solar and storage.

Figure 1 shows the smart meter rollout period for selected utilities, states, and countries. As is evident from this figure, the set targets for smart meter installations were achieved over four years or more in most cases. So when Saudi Arabia commenced a target for 10 million meters as part of its Smart Metering Program (SMP) in February 2020, to be completed by March 2021, this target looked very challenging by comparison. The challenges in managing the logistics of shipping and delivering the smart meters during the lockdown measures enacted in the Kingdom and globally made this task even more difficult. The Saudi Electricity Company (SEC) recently announced the completion of the project, which means the country has achieved this incredible feat in a record time of 13 months (Arab News 2021). The enormity of this task can be assessed by the fact that it required installing close to, on average, 25,000 meters daily, four times that of California and Australia (Figure 2). Finland is the only country with figures commensurate with those of Saudi Arabia.

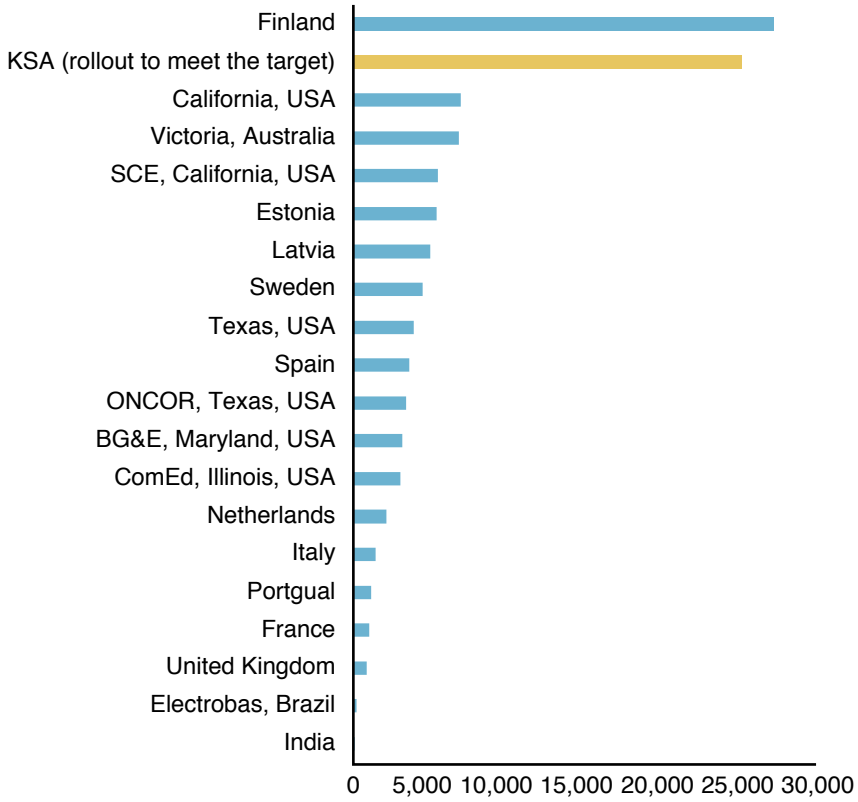
Figure 1. Smart meter rollout period.



Source: Information collected from various sources.

Note: Numbers in parenthesis indicate the achievement with respect to the smart meter target. However, in the case of Brazil, Sweden, Estonia, Finland, Latvia, Netherlands, and Portugal, the achievement has been shown with respect to the market size due to the lack of corresponding data on their smart meter targets.

Figure 2. Smart meter rollout per day.



Source: Information collected from various sources.

Note: The turquoise bars represent the average per day smart meter rollout when normalized with respect to the customer base of ~10 million in Saudi Arabia.

Installing 10 million smart meters in such a short time is indeed a commendable effort. Despite the challenges of Covid-19, the SEC managed to install ~126,000 smart meters in a single day (SEC 2021), a world record, beating China's record of ~104,000 per day. Based on the experiences of other countries, the following steps could be pursued to reap the full benefits of the smart meters.

First, early engagement with consumers is important. Initiating a communications campaign to raise consumer awareness about the benefits of smart meters, including access to energy data, will be crucial for their success. Early messaging can focus on building confidence in the benefits of smart meters by addressing areas of consumer concern, especially those related to data privacy. As awareness increases, these information campaigns can focus on encouraging behavioral change that delivers energy savings. Between 2001-2006, Italy's ENEL Distribuzione (now e-distribuzione) was the first utility in the world to successfully install 31 million smart meters. It also launched a strong national and local communications campaign to increase the acceptance of smart metering installations (Smart Energy GB 2013). Other good examples of early messaging include the "Take control of your electricity bill" campaign in Southern California, "Take charge of your power" campaign in Victoria, Australia, and the "Smart Energy GB" campaign in the United Kingdom (U.K.) (Smart Energy GB 2016).

Second, time-based electricity tariffs are often designed to incentivize consumer participation in reducing peak demand in several jurisdictions. Although time-based pricing has been an important element of smart metering initiatives in most countries, its implementation differs. In some cases (e.g., California, Texas, Illinois, Spain, Denmark), time-varying rates were offered as the default rates for certain consumer classes. In contrast, others (Italy, Sweden, France, Finland, Norway, U.K.) started with opt-in options. The literature suggests that the responsiveness of consumers to time-of-use-based electricity rates not only depends on how the dynamic prices are designed, it is also influenced by other local adaptability factors. In Saudi Arabia, cooling load forms ~70% of household demand due to its hot, arid climate. This makes garnering support for flexible rates challenging.

Third, it is important to design and implement demand response pilot programs as testbeds to understand consumer responses to time-varying rates and quantify the demand response potential. Consumers in various consumption slabs should be able to voluntarily participate in pilot programs. Demand response pilot programs should focus on understanding and addressing the various barriers to demand response. The ex-post analysis of such a demand response program can be valuable in studying the policy-oriented issues of demand response goals and designing effective and efficient price incentives. Many demand response pilot programs have been carried out, mostly in the United States (U.S.) and Europe. They have focused on assessing the demand response potential, cost-effectiveness, price and non-price implementation barriers to understanding consumer behavior.

Lastly, utilities should also develop long-term strategic plans to maximize the benefits of smart metering systems. These plans should include ongoing efforts and future demand response activities. They should be integrated coherently and efficiently with other customer demand-side programs, such as energy efficiency and self-generation. Close cooperation between utilities and regulators, and the regular monitoring of implementation activities is crucial to the success of these strategic plans. California was one of the early implementers of smart meters in the U.S. In 2008, its Public Utilities Commission placed high importance on developing a collaborative long-term comprehensive framework that specified and prioritized key actions and set forth a roadmap for integrated energy efficiency through 2020 and beyond (CPUC 2008).

Smart meters are an important technology that can contribute to the quality of life of electricity consumers. As with all digital technologies, this technology is rapidly evolving and expanding. The continual assessment, evaluation, and enhancement of smart meters and other digitalization technologies will be necessary to continue to garner the benefits of their successful rollout. Saudi Arabia aims to build a ‘smart nation’ by adopting and implementing state-of-the-art telecommunication systems and information and communication technologies to serve the ever-changing needs of its citizens and businesses. In this regard, the SEC’s ongoing efforts in the digital transformation of its management and operational services is a praiseworthy initiative (SEC 2018). The implementation of various digital transformation initiatives, including smart meters, in the electricity sector will contribute to improved customer services, and the reliability and safety of electric services across the Kingdom.

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