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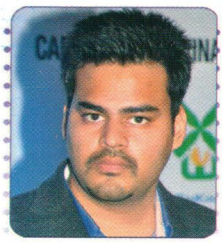

Ketan Mehta
Director, Rays Power Infra(P) Ltd.

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PREPAID SMART METERING

Authored by **Souvnik Roy**

Smart meters are becoming the meter of choice in many countries such as Italy, Sweden, Australia, Canada and UK but is India ready for this advanced technology?

According to recent industry reports, distribution utilities globally are expected to spend US$ 378 billion in smart grid technologies by 2030 where India is estimated to install 130 million smart meters by 2021. Sweden-based analyst firm Berg Insight says that penetration rates for smart metering technology will grow to around 50% in Europe and North America, and to over 75% in the Asia- Pacific region from just around 15% to 25%, respectuvely, today. And by 2020, it estimates that penetration rates for smart meters are expected to approach 100% in most developed countries, with massive rollouts also taking place in new smart meter territories such as Latin America, India and the Middle East.

As India takes steps towards modernizing India's grid system by investing in AMI, through this article we take a look at the conventional prepaid metering systems, the advantages and disadvantages of conventional prepaid systems, the concept of Advanced Metering Infrastructure (AMI), and the benefits of prepaid smart metering over the conventional metering systems.

INTRODUCTION TO CONVENTIONAL PREPAID METERING SYSTEM

Conventional meter reading system uses a smart card or a token that is read and stored within the meter. An electronic prepaid meter will act as a "bank", as long as some credit is available inside the meter, services (supply of electricity or gas or water) will be made available to the customer. The level of credit inside the meter will be deducted according to the tariff as programmed for the respective customer. The prepaid meter issues warnings when the credit reaches a threshold or zero. Also the conventional prepaid meters have an emergency credit which could be used after the credit becomes zero. After the use of emergency credit, the service is disconnected. Customer needs to recharge the smart care or token and eventually the prepaid meter to avail the services again (reconnect).

DISADVANTAGES OF CONVENTIONAL PREPAID SYSTEMS

- Additional hardware cost and maintenance cost
- Potential Safety issues – Appliances/systems can be switched on when the service has been termi-

nated. When the prepaid system is being recharged, it could cause potential safety issues.

› Increased surcharges charged to the customer to finance and maintain the prepaid meters

› Customers cannot choose dynamic rate plans like Time of Use pricing (TOU), Critical Peak Pricing (CPP) or real time pricing. This requires field visit to configure such rate plans on the meter.

› Credit is only available from certain outlets. Also it is required that the customer is at the premise to recharge the meter.

› Best energy deals on the market aren't available to prepayment customers.

› The meter may continue to collect fixed charges even when there is no credit on the meter, depending on which type of meter it is.

› It is more expensive than Direct Debit and on-line payment methods.

› If the customer is repaying a debt through meter, customer may not be able to switch to another supplie

› Inconvenience - will often require trips to a shop to 'top up' keys and smartcards

ADVANCED METERING INFRASTRUCTURE?

AMI (Advanced Metering Infrastructure) is the collective term to describe the whole infrastructure from Smart Meter to two way-communication network to control center equipment and all the applications that enable the gathering and transfer of energy usage information in near real-time. AMI makes two-way communications with customers possible and is the backbone of smart grid. The objectives of AMI can be remote meter reading for error free data, network problem identification, load profiling, energy audit and partial load curtailment in place of load shedding.

AMI AND ENERGY METERING

Benefits from Conventional Prepaid System

Benefits to end customers	Benefits to Utility
Pre-plan the budget required for paying utility bills	Reduction in collection of customer's debt
No additional charges are imposed on the customer upon connect	Reduced paper work as the customers are not billed on a regular basis
Customers don't need to pay security deposit to avail the services	Enhances in reduction of customer energy consumption
Improved customer service with the control left to the customer	Reduced financial risks - Enhances utility to receive payments ahead of the energy consumptions
No problems of unsettled bills	Improved operational efficiencies - Reduced cost of meter reading

The development of Advanced Metering Infrastructure or AMI system has brought the greatest change in the technology of energy metering. The technology upgrades from mechanical rotating disc energy meter to electronic energy metering device and then to intelligent energy meter, called automatic meter reading (AMR). This technology helps send energy consumption data from buildings, factories and houses to the utilities for load curve, power quality analysis and consumers' billing purposes. In the meantime, the Advanced Metering Infrastructure (AMI) is also introduced to integrate the meter with grid and households for better analysis of transmitted power and usage. The AMI technology includes two-way communication between utility companies and customers' smart meter. In order to deploy AMI system into electric distribution system, seven systems inside the smart meter need to be considered namely, system communication, system control, remote communication and monitoring, system security, remote software upgrade and data collection and encryption

PREPAID METERING THROUGH THE VIRTUE OF AMI

With Smart Grid and Advanced Metering Infrastructure (AMI) in place, utilities do not require prepaid meters to serve the prepaid customers. A simple smart meter with remote connect-disconnect switch can perform the function of prepaid meter. With powerful interval data available at utility's disposal, utility application(s) can calculate the credit left on the prepayment account and can initiate necessary actions like generating alerts, performing disconnect/reconnect etc. With the AMI architecture in place, many of the disadvantages of the existing prepayment metering system would be addressed.

› Smart AMI meter will be installed at customer's premise which can operate on credit mode or prepayment mode. Such smart meters will be equipped with remote connect-disconnect switch.

› Customer can opt to be on credit-billing or prepayment billing and this will be performed at the Utility application - Customer Information System (CIS) and/or prepaid application.

› AMI meters provide interval reads on a daily basis and is stored in Meter Data Management System (MDMS).

› The rate at which the customer will be billed is stored in Customer Information System (CIS).

› MDMS feeds interval reads to CIS and Prepaid application. These two applications in conjunction

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will calculate the bill periodically (daily or twice a day) and would deduct the bill amount from the available credit.

› When the available credit reaches a threshold, alerts can be sent to the customer. Alerts can be sent via SMS gateway or IVR's outbound calling system or email or In-Home Display units (IHD).

› When the available credit reaches zero, additional alerts are sent. Certain regulations recommend an emergency credit to be available. In such case, when the credit reaches the emergency credit threshold or when the credit reaches zero (when there is no concept of emergency credit), CIS/ Prepaid system issues remote disconnect request to the AMI meter.

› Customers can make the required payment using existing infrastructure like web payments, payment kiosks, check payments, IVR payments etc. Once CIS system receives the payment/memo; it issues a reconnect request to the AMI system.

› Certain CIS systems have the capability of performing the prepaid application. In such case, a separate prepaid application is not required.

› The proposed solution could be extended to provide smart prepayment services. For example, this service can be extended to the function of charging PHEVs. When PHEVs are charged in the charging stations, the cost required to charge the PHEVs can be deducted from the prepayment account; provided customers use the same prepayment account.

BENEFITS OF SMART PREPAYMENT SYSTEM

Following are the benefits of implementing a smart prepayment system that is controlled by the utility applications.

› Utilities don't need to invest on hardware cost (purchase of prepayment meters) and the maintenance and field force cost associated to it.

› Customers have the luxury to switch between credit meters and prepaid meters on the fly without additional overhead of field visit

› Prepayment customers have the luxury to change their rate plan and opt for attractive rate plans like Time of Use billing, Critical Peak Pricing and real time pricing. The billing is performed at the utility application instead of the meter hardware, hence attracting prepaid customers to participate in energy conservation rate plans.

› Customers don't need to carry smart cards or tokens or need to be at the meter location to recharge the prepaid meter. Customers can use SMS, phones, web or call center application to recharge the prepayment account.

› Since the overhead on the hardware and field force is reduced, cheaper prepaid rate plans would attract the customers.

› Existing payment mechanisms will be used to charge the prepaid accounts. No additional payment mechanism is required.

› Customers with medical conditions can still enroll into smart prepayment and the CIS/prepaid application can handle the issue of not issuing disconnect for special customers.

› With IHDs and Smart Portals in place, customers have an effective way to maintain the smart prepayment account, to understand the usage pattern and methods to limit their usage within their available credit.

› Utility doesn't need to put in additional infrastructure to provide this functionality. Existing AMI infrastructure would be leveraged.

› With regulations permitting, there would be no reconnect charges.

DISADVANTAGE OF SMART PREPAYMENT SYSTEM

› Most of the utilities receive interval reads only once a day, probably during the off peak hours. Hence reevaluating the available credit and issue of disconnect request to AMI systems might happen at off peak hours causing inconvenience to the customers to be disconnected during night hours.

› Most of the utilities receive interval days once a day. Hence the disconnect request cannot be sent to AMI systems when the available credit exactly reaches the threshold.

CONCLUSION

Utilities are embarking Smart Metering deployment strategies; replacing conventional meters with smart AMI meters. With the increase in awareness of prepaid metering systems, it is required to implement a prepayment system that is independent of the meter hardware, providing attractive rate plans to such customers. Hence, Utilities can exploit the AMI infrastructure and interval data to provide the prepayment function instead of procuring and maintaining smart prepaid meter hardware. This would provide a win/win proposition to the utility, regulators and the customer ■

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