

# Are We Ready for Era of Smart Prepaid Services?

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## ABSTRACT

Smart Grid opens up a new genre of a prepaid metering system for the utility, one which is a win-win proposition. A play around the backend systems rather than the meter itself ensures benefits realization not just for the utility but also customers and the regulators, thus encompassing the entire value chain. Conventional prepaid metering system uses cards or reliable semi smart tokens or integrated keypad to recharge the prepaid meter. Prepaid meter accommodates the required hardware to recharge and determine the remaining credit on the customer account. The rate at which the customers are billed is also configured at the meter hardware. Hence field visit or meter exchange is required if the customers need to opt for alternate rate plans.

With utilities embarking smart metering deployment, utilities do not require smart prepaid meters to serve the prepaid customers. A smart meter with remote connect-disconnect switch can perform the function of both prepaid meter and credit 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. This article demonstrates how the smart meter and utility applications in conjunction can perform the function(s) of a prepaid meter and the benefits that utilities and customers would enjoy. This function is also extensible to provide meter independent services like charging the vehicles at the charging station using the same prepaid account.

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### Introduction

There are 5.8 million prepayment meters in use in Great Britain, 14% of electricity consumers (3.6 million) and 10.4% of gas consumers (2.2 million) use prepayment. The number of prepayment meters installed has increased substantially over the past decade – including a 150% increase in gas prepayment<sup>1</sup>. USA is slowly moving towards prepayment system, few of the utilities to be mentioned are Salt River Project, Nations Power Texas<sup>2</sup>. Prepayment meters are also predominantly used in Australia (in Tasmania, the Northern Territory (Aboriginal communities) and southern Australia). South Africa has the highest penetration of prepayment meters (for electricity) in the world, with 54 per cent of its 7.3 million electricity customers having prepayment meters (ABS Energy Research 2007:22)<sup>3</sup>.

### Conventional Prepayment 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 card or token and eventually the prepaid meter to avail the services again (reconnect).

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### Benefits of conventional prepayment system are:

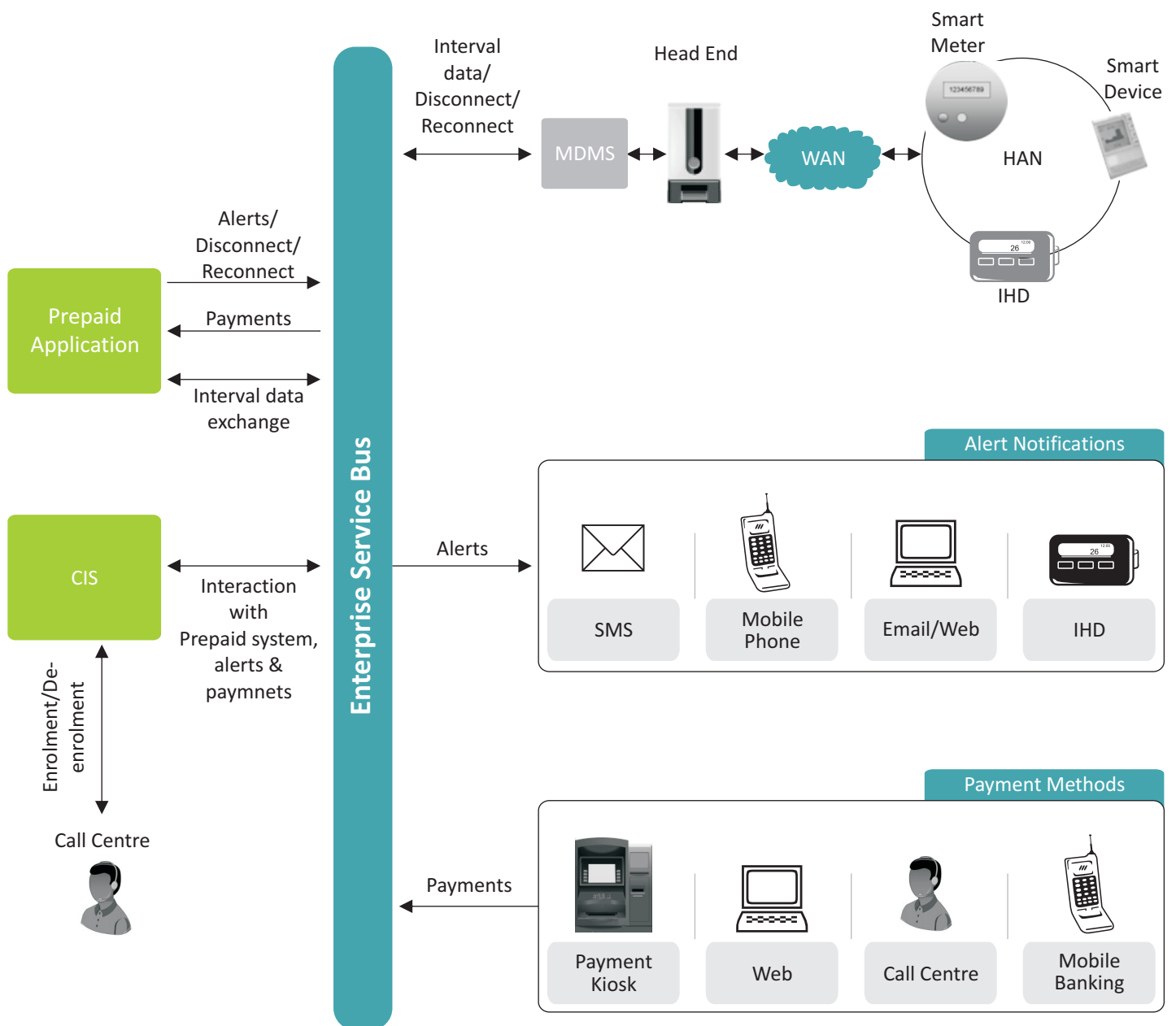
Benefits to end customers	Benefits to Utility
Preplan the budget required for paying utility bills	Reduction in collection of customer's debt
No additional charges are imposed on the customer upon reconnect	Reduced paper work as the customers are not billed on a regular basis
Customers don't need to 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
	Enhances call center efficiency – Reduced customer complaints (ex: High bill, outbound calls from IVR etc)

### Disadvantages of conventional prepayment system are:

- Additional hardware cost and maintenance cost
- Potential Safety issues – Appliances/systems can be switched on when the service has been terminated. 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 supplier (UK market scenario).
- Inconvenience - will often require trips to a shop to 'top up' keys and smartcards

## Prepayment system in the world of Smart Grid

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 below architecture in place, many of the disadvantages of the existing prepayment metering system would be addressed.



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- 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 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 meter agnostic solution which could be extended to other functions like charging the PHEVs. This would provide a win/win proposition to the utility, regulators and the customer.

### References

1. National Energy Action - <http://www.nea.org.uk/prepayment-meters/>
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### About the Author

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