Wireless Smart Metering for Commercial and Industrial Customers

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1 Executive Overview

As the demand for new sources of energy rises, so too does the demand for more efficient use of existing energy sources. Consequently, Ontario must lay the foundation of a new "culture of conservation" by implementing enabling technologies that will successfully facilitate demand-side management and response. These tools of demand-side control must not merely measure the after-effects of conservation, but rather must encourage and empower the end-users to reap the benefits of their conservation. The recommendations provided by SmartSynch® in this document focus on the requirements necessary to provide cost-effective and conservation-inducing smart metering technology that can successfully synchronize the distributors' supply goals with the consumers' demand needs such that both groups will promote conservation within the framework of an achievable, sustainable and energy-efficient market.

SmartSynch is uniquely positioned to provide guidance on these requirements. SmartSynch Inc. (SSI) is the leading provider of smart metering solutions throughout North America with an installation base of twenty-eight utilities. Since the introduction of SmartSynch's SmartMeter System (SMS) approximately 4 years ago, the company has deployed more poly-phase meters with embedded wireless communications than any other company. Furthermore, SmartSynch has accumulated a wealth of smart metering expertise from the following:

1) **Feedback from its extensive installation/customer base**. SmartSynch has deployed smart metering systems to numerous utilities, many which are considered to be progressive leaders in the application of metering technology. *Correspondingly, these utilities have provided SmartSynch with deep subject matter expertise*.

2) **The industry knowledge of its partners such as Elster Electricity LLC, Itron Inc., and Itron Metering (formerly Schlumberger Electricity Metering)**. These partners are leading technology providers and knowledge sources for the global energy industry. Several thousand utilities worldwide rely on their products and services. The combination of its partners' broad knowledge base with SmartSynch's focused technology expertise provides cost-effective solutions for the commercial and industrial (C&I) arena that are efficiently integrated into the overall technology objectives of each utility. *Effective smart metering does not rely solely on intelligent data collection technology, but instead is predicated on utilizing the data wisely throughout the organization.*

3) **Energy industry forecasting by SmartSynch's influential group of investors**. SmartSynch's investors include many of North America's predominant energy industry leaders including those with a unique understanding of and stake in Ontario's present and future energy needs. *Blending its current deployment successes with its insight into future energy industry trends, SmartSynch affords immediate high-impact solutions that fulfill and sustain long-term utility goals.*

By leveraging its knowledge base, SmartSynch has assimilated the following list of success determinant factors, which should be addressed when considering implementation of a C&I smart metering solution. These guidelines constitute a roadmap by which each utility can more effectively promote change towards a culture of conservation while satisfying and exceeding their immediate metering demands.

2 C&I Smart Metering Essentials

2.1 Institutional Certification of Quality

In order to easily verify and benchmark the quality of the solution, the smart meter should be certified by a variety of leading industry standard testing organizations. Where applicable, these include certifications from Industry Canada (IC), the Federal Communications Commission (FCC), and the American National Standards Institute (ANSI). These organizations spend significant resources ensuring that the quality (or lack thereof) of a product does not negatively affect the well being of the consumer or the economic prosperity of the distributor.

2.2 Minimization of Installation & Operational Costs

Installation and operational costs drive successful return on investment in smart metering. Embracing the following requirements may lead to a considerable reduction in the overall cost of implementation and operation, which correspondingly increases the rate of return.

2.2.1 Under The Cover Solution

All components of the smart meter solution should be placed “under glass” as part of the existing meter housing unit. This solution provides the most cost-effective and expedited deployment by eliminating the additional expense and time related to external housing unit and wiring installation.

2.2.2 Communication via Publicly Available Network

The smart meter solution should utilize a publicly available network for commercial use. In the C&I market, consumers are typically dispersed over a wide geographic area such that the build-out of a private network is less feasible and more capital intensive. By contrast, public network solutions support more cost-effective automation of C&I meters by employing existing infrastructures with broad geographic coverage. Furthermore, utilities may devise a more flexible deployment plan based on strategic objectives rather than being constrained by build-out location.

2.2.3 Wireless Communications

The smart meter solution should utilize a wireless network. Antiquated Automated Meter Reading (AMR) systems utilizing phone modems incur economically stifling communication costs. Wireless network costs are much more affordable than the legacy phone-modem alternatives. Significant recurring operational cost savings can be garnered by wireless network implementations. Additionally, wireless solutions provide greater reliability than phone modem solutions that have a high rate of call failure and dropped connections.

2.2.4 Remote Configuration and Service via Head-End Software

The smart meter solution should provide a mechanism for modifying configuration and scheduled events remotely via a head-end software platform. This functional flexibility minimizes costly return visits to the meter for configuration and servicing issues by enabling adjustments to be initiated and completed immediately from within the business operation facilities.

2.2.5 Perpetually Rechargeable Back-Up Power Source

The smart meter solution should incorporate a rechargeable back-up power source that never needs to be replaced. This power source allows for controlled power outage operations and eliminates the need for non-rechargeable batteries that must frequently be replaced by costly return visits to the meter.

2.2.6 Coverage Validation

Deployment of the smart meter solution should be supported with tools that assist in verification of coverage either prior to or during installation. These tools validate the communication quality of an installation site and identify meter sites that will require an external antenna for high-grade communication to the head-end software.

2.3 Heterogeneous Data Acquisition

Flexible data capture is the key to building effective conservation inducing consumer rate plans. The smart meter solution must be diverse enough to capture different types of data for different classes of consumers so that rate incentives can be tailored for maximum consumer benefit.

2.3.1 Time of Use

The smart meter solution should support Time of Use (TOU) functionality where consumption can be aggregated into rate "bins" based on the time of usage. This allows distributors to provide varying price alternatives to consumers based on multiple peak and off-peak rate structures thus providing direct incentive to conserve during periods when the highest energy usage is anticipated.

2.3.2 Critical Peak Pricing

The smart meter solution should support Critical Peak Pricing (CPP) functionality that enables distributors to designate specific "super-peak" periods of time dynamically as energy prices warrant. During Critical Peak periods, consumption is aggregated into a special rate bucket that supersedes existing TOU rate structures. By offering CPP rate plans, distributors can provide dynamic conservation incentives to consumers based on energy market fluctuations.

2.3.3 Interval Metering

The smart meter solution should support Interval Metering. Measurement of electricity usage within pre-defined interval periods enables the distributor to provide fine-grained feedback of energy usage to the largest consumers on a daily or even near-real time basis. Furthermore, Interval Metering affords the greatest flexibility to implement future rate structures.

2.3.4 5-minute Intervals

The smart meter solution should support intervals as small as 5 minutes. Although the majority of meters will not utilize 5-minute intervals, this level of granularity enables the largest consumers to implement load research applications and to make near-real time consumption decisions.

2.3.5 Pulse (KYZ) Output

The smart meter solution should support Pulse (KYZ) output. This enables larger consumers to monitor usage via an in-house energy management system.

2.3.6 Scheduled Data Acquisition

The smart meter solution should allow for the configuration of future scheduled data reads, events and tasks. This feature provides the most efficient way to automate repetitive tasks and reduce daily user interaction thus freeing resources to focus on more urgent priorities.

2.3.7 On-Demand Data Acquisition

The smart meter solution should support on-demand reads and ad-hoc requests for data from the meter. This feature provides data in a timely fashion and allows the distributor to dynamically react to evolving issues and needs.

2.3.8 Automatic Data Recovery

The smart meter solution should support the automatic recovery of missing data. The system should be capable of automatically re-requesting reads which have not been returned as scheduled. This ensures the completeness of data and avoids time-consuming manual intervention by the distributors' resources.

2.3.9 Aged Data Retrieval

The smart meter solution should support the retrieval of aged data still present on the meter in the event of missed reads. This mitigates the risk of missed reads or incomplete data acquisition.

2.3.10 Configurable Storage Capacity

The smart meter solution should support a configurable storage capacity so that the amount of historical data stored within the meter may be adjusted to the requirements dictated by any utility oversight regulations.

2.3.11 Automatic Clock Synchronization

The smart meter solution should have the capability to automatically synchronize the meter clock with a reference/atomic clock. Over time, most meter clocks deviate to some degree. Automatic Clock correction/synchronization guarantees the most accurate representation of usage over time.

2.4 High Impact Reporting

Data accessibility provides consumers with the tangible feedback that drives demand response and distributors with the consumption data necessary to derive the best customer sales and support strategies. The marriage of high data availability with tailored service plans promotes a healthy and sustainable energy market characterized by incentive based consumer conservation and positive distributor economics.

2.4.1 Real-Time Interval Reporting

The smart meter solution should support real-time reporting whereby interval data may be returned at the end of each interval. Real Time Interval Reporting enables distributors to offer effective load curtailment programs through which consumers are motivated to modify their consumption as a result of fast access to their usage data during the curtailment event.

2.4.2 Configurable Alarm Reporting

The smart meter solution should have the ability transmit various alarms autonomously as certain configurable thresholds are reached. Furthermore, the distributors should have the ability to configure the types of alarms about which they are most concerned. A sampling of the alarm events that should be supported include:

- Power Outage or Restoration Alarms
- Demand Threshold Alarms
- Reverse Rotation and Tampering Alarms
- Meter Time/Clock Error alarms

2.5 Secure and Responsive Communications

Communications between the meter and the head-end software should be secure, bi-directional and fast. Security uncertainties and performance impediments within the communication layer risk the efficacy of the entire solution. Furthermore, reliable two-way

communications allow utilities to proactively retrieve data based on changing daily dynamics.

2.5.1 Secure Communications

The smart meter solution should utilize end-to-end encrypted communication between the meter and the head-end software. Encryption reduces the risks of data theft and security breaches.

2.5.2 Two-Way Communications

The smart meter solution should utilize two-way communications between the meter and the head-end software. Two-way communications permit the distributor to enact on-demand reads, schedule changes and monitoring modifications after installation.

2.5.3 Real-Time Response

The smart meter solution should provide real-time response. Near immediate response is a necessity for ad-hoc requests where access to immediate information is paramount.

2.5.4 External Antenna

The smart meter solution should provide for an optional external antenna that includes an isolation circuit for safety. The external antenna ensures high quality communication between the meter and the head-end software when meters are located underground or in enclosed cabinets.

2.6 Head-End Software Features

The Head-End software is the catalyst for improved operational efficiency. The Head-End software should be scalable, standardized, flexible, easy to use and require minimal resource overhead during installation and operation. Furthermore, the Head-End software should allow existing distributor resources to maximize their productivity within the framework of the existing information technology environment.

2.6.1 Multiple Meter Manufacturer Support

The smart meter software should support meters from multiple manufacturers. This provides distributors the ability to select from a variety of solutions as needs or pricing dictate and eliminates the risk of locking into to a single manufacturer.

2.6.2 Multiple Network Support

The smart meter software should support multiple network types and multiple network carriers. This provides distributors the ability to achieve maximum communication coverage and to select from a variety of data plan options that best fit their needs.

2.6.3 Standards Based Software

The smart meter software should utilize industry standard open architectures and relational databases so that it most effectively fits into the existing Information Technology infrastructures of the distributors.

2.6.4 Scalable Platform

The smart meter software should support maximum scalability. As the software will be a long-term business driver for distributors, it should have the demonstrated capability of supporting the largest C&I meter populations.

2.6.5 Minimal Desktop Support

The smart meter software should require minimal desktop support during implementation of the metering solution. A browser-based interface is the most

universal solution with the least support requirements. Reduction of desktop support allows the distributors to focus their Information Technology resources on server configuration and support.

2.6.6 Production and Meter Shop Environments

The smart meter software should support utilization in both the production and meter shop environments. This allows for testing of the meters prior to deployment in the field.

2.6.7 Message, Alert and Alarm Routing

The smart meter software should provide a message routing facility that can send messages, alerts and alarms to one or multiple resources via standard e-mail.

2.6.8 Logical Grouping of Meters

The smart meter software should provide logical grouping of meters. Meter grouping permits support for billing cycle reporting and exporting. Furthermore, execution of tasks at the group level provides the most efficient mechanism for configuring large numbers of meters with minimal user interaction. Consequently, the system should support the establishment of schedules at the group level that are automatically programmed into all meters added to the group. In addition to scheduling at the group level, on-demand requests or configuration changes should be available at the group or individual meter level to provide the greatest data acquisition and configuration flexibility.

2.6.9 Troubleshooting Tools

The smart meter software should provide tools for identifying meters that are not reporting as required. These tools should aid in determining whether reporting issues are meter, communication module or network related.

2.6.10 Event, Task and Response Monitoring

The smart meter software should support viewing of all field and application events. This provides distributor resources with the most accurate view of the current state of system requests and responses.

2.6.11 Seamless Export Interface

The smart meter software should seamlessly export data to external systems using industry standard formats such as Native MV90, the Hand-held Reader File Format (HHF) or the California Metering Exchange Protocol (CMEP). These export interfaces provide a simple mechanism for transferring billing and interval data from the Head-End software to other systems utilized for web presentment and consumer billing.

2.6.12 Data Archival and Restoration

The smart meter system should provide archival of data for which online access is no longer required as well as restoration of archived data for on-line use. Archival functionality reduces database load and maintains optimum system performance. Furthermore, the ability to restore archived data provides the distributors a mechanism for retrieving historical data as requested by customers or required to settle billing disputes.

3 Summary

The Ontario Energy Industry is at a crossroads where prudent technology choices will foster the long-term welfare of the energy market. Distributors and consumers need not greet these choices with skepticism or trepidation. Reliable and proven smart metering technologies capable of facilitating a culture of conservation and averting an impending energy crisis do exist. By embracing these enabling technologies, distributors will be able to provide tangible consumer incentives that empower consumers to reap the benefits of their conservation efforts while simultaneously ensuring long-term distributor profitability.

Ultimately, only the unification of these consumer and distributor ambitions can provide the market mechanics necessary to achieve sustained energy efficiency in Ontario. Thus the guidelines contained herein strive to afford distributors the ability and consumers the motive to effect positive change. When successfully implemented, the smart meter solution will benefit all of society by making conservation a desirable requirement of good citizenship.