WORKING GROUP 3
INFORMATION FLOW-TECHNOLOGY

Final Report
August 11, 1998

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1. Executive Summary

Working Group 3 of the ESCO Metering Subgroup is one of five Working Groups composed of interested parties which are examining the issues surrounding the development of competitive metering identified in the Public Service Commission's Opinion No. 97-13, *Opinion and Order Establishing Regulatory Policies for Competitive Metering* (Opinion No. 97-13). Working Group 3 was charged with examining the technology-related issues affecting the development and implementation of an unbundled metering system. Operating in close coordination with the competitive model developed by Working Group 2 (Information Flow Policy), and the control of Service End Points and related issues identified by Working Group 1, Working Group 3 examined the technology requirements necessary to achieve the proposed competitive framework .

In order to complete this task Working Group 3 examined a number of issues and questions, focusing upon the technology aspects of the implementation of competitive metering. The final set of questions for Working Group 3 thereby became the following:

1. Does the existing technology prevent metering from becoming a competitive service?
2. Is the competitive model proposed by Working Group 2 technologically practical and feasible?
3. What is "Open Architecture" and how applicable is it to the proposed model?
4. What further work needs to be done to implement a competitive metering system in New York?

1.1 Metering Technology Requirements:

Working Assumptions

The approach in Working Group 3 was to determine a base level technology for the competitive metering model developed in Work Group 2, and to assume that higher level functionality would be made available to customers. The Working Group determined that the following considerations should apply in determining the metering technology requirements for an unbundled system:

1. The model assumes interval data, where applicable, will be recorded hourly for billing purposes; usage data will be recorded hourly and in most cases collected monthly for billing purposes. Shorter intervals may be used for ESCOs providing additional metering services or as the Energy Provider systems require. Overall the model focuses on minimum requirements, with the market providing higher functionality that market participants desire.
2. Enhanced metering will be available to customers who request it from their energy provider and are willing to pay for it.

3. Whoever is supplying the non-T&D utility metering services will have to supply the T&D Utility with the data necessary for appropriate rate billing and system support.
4. Customer bills may be derived from statistical load profiles applied to meter usage. It is possible that over time customers will migrate to interval metering to avail themselves of hourly pricing. The rate of this migration is currently not known. It will depend in part upon the competitive services offered.
5. Other factors that can affect the development of competitive metering services may include:
    - Hourly market prices and price signals to customers;
    - Value-added services offered by competitive entities in the market;
    - Consistent application of the model;
    - Market Participant needs;
    - ISO requirements for settlements and balancing;
    - Provider of Last Resort requirements.

The Model Incorporates Retail Access Baseline Data Requirements

The competitive metering model is built upon the retail access requirements which have been identified to accommodate competition in the commodity electricity market. The following requirements serve as the baseline for developing a competitive metering system:

1. Total consumption (kWh) must be recorded for all customers, and peak demand (kW) and/or reactive power (VARs) must be recorded for any customer whose distribution tariff requires these measurements for billing.
2. The data collection frequency is based on settlement requirements.
3. Meters must have a visual read capability.

The competitive metering model developed by Working Group 2 satisfies the basic retail access requirements listed. If the model is implemented, and developed further, these requirements must be accommodated.

1.2 Summary Conclusions, Recommendations

Working Group 3 has concluded that the model for unbundling metering services developed in Working Groups 1 and 2 can function effectively using currently available technology, and the model supports the Commission's vision of a competitive retail electricity industry.

Successful implementation of retail access requires the development of robust systems to exchange data among service providers. Successful implementation of unbundled metering services requires further development of information exchange mechanisms to ensure that any authorized entity involved in any aspect of metering services receives the information it needs to meet its responsibilities at the time the information is needed, that meter data are processed and provided to appropriate authorized parties according to protocols agreed upon by the market participants, and, finally, are transmitted to the appropriate authorized parties next in need of the data.

The Competitive Metering Model is Workable with Existing Technology

This Working Group is confident that the systems called for by the model can be developed and function effectively. Indeed, very similar systems have been and are being developed by market participants in other jurisdictions. It is also expected that in the early stages of a competitive metering environment only a small percentage of customers will have interval metering. The monthly energy use data requirements for most customers will be satisfied by a single measure of energy usage. The T&D utilities will therefore have time to scale up the systems they develop to implement competitive metering, but the T&D utilities note that developing utility systems for implementing their responsibilities under the model will require significant resources.

Open Architecture is a Practical Concept from the Meter Reading Output Interface to the Output of the CAVEE

The Group also looked at the question of "Open Architecture". Open Architecture is the notion that metering-related data can be exchanged among authorized parties from an access point to the point at which data are of billing quality. The Working Group concludes that Open Architecture is practical and feasible from the meter reading output interface through translation and validation processes that produce billing-quality data. Although protocols are currently not standardized, the lack of standardization does not prevent data from being freely processed in the unbundled metering model.

The Model Accommodates Interval Usage Data Reported Monthly

The Working Group cautions that changes to the model which have the effect of dramatically changing either the frequency or quantity of data which must be exchanged may have a substantial impact on the nature of the systems handling the data flow. The competitive model is built upon the assumption that interval data collected monthly may be used for billing purposes. These conditions are sufficient for the model to function effectively at this time. As the competitive market develops, the availability of Automated Meter Reading (AMR) can help accommodate increased data needs.

Provider of Last Resort Concerns Are Not a Barrier to Implementing the Model
The Commission has determined that at least during the transition to competition, the incumbent utilities will be the "provider of last resort" (POLR) for electric energy service. The working group believes that nothing in the competitive metering and billing model is a barrier to the POLR requirement for electricity service. We note that some parties believe that additional standards should be applied at the meter level that would assure that the POLR could read the meter with minimal changes to its meter reading system..

Universal Identifiers for Service End Points
The development of a Universal Identifier system for Service End Points has merit. Its development can serve the needs of both Retail Access and a competitive metering services environment by providing a common means for identifying any service end point and ascertaining that end point's status for billing. Universal Identifiers may be desirable, but are not necessary to implement the model. This subject needs further investigation as a follow-on item.

Further Work will be needed to Implement the Model
Finally, it is important to note that if the competitive metering model is adopted by the Commission, additional work needs to be done to implement the model. We have attempted to identify the major additional tasks in this report in Section 9, however this list may not be exhaustive.

2. Introduction

In compliance with Opinion No. 97-13, meetings of the interested parties were convened in mid-August 1997 to formulate an approach to study the issues associated with competitive metering. As a result of these meetings, five working Groups emerged, each with its own review charter and with a Group leader appointed by Group consensus. The Groups are as follows:

Working Group 1 ……………. Meter Ownership and Control
Working Group 2 ……………. Information Flow/Policy
Working Group 3 ……………. Information Flow/Technology
Working Group 4 ……………. Regulations
Working Group 5 ……………. Load Profiling

A list of contributing working Group 3 members can be found in Appendix A. Working Group 3 developed a work plan intended to give the group direction in its discussions. The group started with a broad focus across the entire Working Group discussion spectrum, because there are technology issues in each area. However, as the work progressed in all the working groups, Working Group 3's direction became focused on the competitive metering model developed by Working Group 2. That model allows each of the three unbundled functions ([1] meter reading, [2] meter data translation, and [3] customer association, validation, editing and estimation) to be competitively offered by multiple entities. Eventually, while Working Group 2 also focused on identifying specific means for ESCOs to obtain access to metering data, Working Group 3 considered some of the technical ramifications of the competitive model and the data collection, analysis and transmission requirements that emerged from the model.

The process employed by Working Group 3 utilized monthly day-long meetings to review and discuss issues. As the competitive model emerged and Working Group 3's focus sharpened the group met more frequently. As done in Working Group 1, Working Group 3 agreed that the meeting format would rely heavily on presentations and other prepared documents that would serve as the basis for discussion. Every effort was made to reach consensus positions and where necessary, contested positions were documented. This final report was opened to further comments by all interested parties.

3. Description and Economics of Advanced Metering

This section describes metering development, advanced metering, communication technologies, and various automated meter reading technologies. In an unbundled metering services environment, Meter Service Providers may seek to optimize functionality and efficiency through the implementation of one or more advanced metering technologies. Advanced metering technologies that are currently available can supply Energy Providers and customers with more information than is typically provided by the traditional meter. The increased information available through advanced metering can also assist market participants in tailoring products and services for their target markets and customers.

The section also discusses cost factors that affect deployment of various types of meters, meter reading systems and communications. It is important to note that metering technologies are going through a period of rapid development. Costs for many types of functionality are decreasing as retail access opens up a greater demand for advanced metering. It is also important to note that currently no single solution for providing advanced metering services meets the total needs in any given service territory. Every advanced metering system is in some respects a hybrid designed to meet customer and system needs at the optimal costs. Large scale advanced metering implementations will almost always include a mix of technologies and therefore a mix of cost factors and costs. This section presents information to indicate the magnitude of current estimated price ranges for some advanced metering equipment and services, but these costs are not intended to be regarded as complete or definitive.

Cost Study
The variety of metering equipment, services and implementations makes it difficult to accurately characterize costs of delivered metering services. A consultant study is being commissioned to address these issues. The study will examine a baseline bundled meter services scenario and several likely competitive scenarios to characterize the approximate costs that will result from different paths and implementations of metering services.

3.1 Introduction

Advanced metering typically can encompasses three different components:

- Meter
- Communications technology module
- Automated Meter Reading (AMR) system.

The communication and AMR components are not required for either accurate metering or meter reading. Without advanced communication functions, meters can be read with an on-site visit either visually or via the optical port with a hand held reader. These components can, however, provide an economical method to remotely acquire the significant amounts of billing and system performance information located in an advanced meter.

Communications can be added to the meter to allow the meter to be read remotely. An operator at a computer can manually perform the remote read or, the meter with communications can be incorporated into an AMR system, which reads automatically. Advanced communications in the meter does not, however, mandate an AMR system.

Each advanced metering component has many manufacturers that provide a variety of product lines that use multiple technologies. These technologies have different functionalities that require different operating systems. The price of a technology will vary with different product styles. The user of these products must determine the required functionality, select the desired technology that performs the required functions, and select the products that best meet the overall requirements, while also meeting financial objectives.

Functionality, volume, and technology drive the price of an advanced meter, communication module, or an AMR system. Typically, for meters and communications modules, the higher the functionality, the higher the price, and the higher the volume, the lower the price. For AMR systems, typically the more meter reading points, the lower the cost per point.

3.2 History of Metering Development

3.2.1 Watt Hour Meters

Traditionally, utilities measured electricity usage as energy in kWh (kilowatt-hours) and as demand in KW (kilowatts). Initially, metering was accomplished utilizing electromechanical meters. The first electromechanical meters were energy only, with a four or five dial mechanical register to indicate the energy consumption. Today, most residential customers still utilize this metering technology.

As demand was recognized as an important element, electromechanical meters were developed that also measured demand (KW), in addition to energy consumption. Demand is defined as the maximum rate of energy usage over a specified period of time, such as 15 min or 30 min. Demand influences the size of transmission lines, transformers, and other equipment.

Although these electromechanical demand meters were more expensive than energy meters, the value of the information provided by these meters offsets the increased product costs. These meters were manually read on a regular schedule, most often monthly or bi-monthly.

3.2.2 Interval Metering

As electricity usage grew, and generation, transmission, and distribution technologies advanced, requirements for additional data changed metering requirements. Interval metering became a method to look at energy usage by time intervals. A recording/translation system was developed to provide interval data.

During the 1970's, electronics had not progressed sufficiently to record interval data within the small spaces inside the meter. To meter for interval data, an electromechanical recording system was developed that consisted of a pulse initiator located inside the meter, and a magnetic tape pulse recorder located outside the meter.

Electromechanical Interval Recorder

A pulse initiator generates contact closures at a rate proportional to the energy used. The pulses are made available external to the meter via a cable that connects to the pulse initiator contacts. The cable exits the meter via a hole in the base. The pulse initiator generates pulses as the disk turns by reflecting light off of reflective surfaces located on the meter disk.

A magnetic tape recorder is a motor driven device comprised of some basic electronics and a magnetic tape cartridge. A motor slowly turns the magnetic tape in the cartridge. The recorder receives pulses from the meter, and the recorder electronics places a magnet marker on the magnetic tape for each pulse received. The advancing magnetic tape prevents marker overlapping. Magnetic marks are also automatically placed on the magnetic tape to mark time intervals. This technology requires that the metering site is visited monthly, the magnetic tape cartridge is replaced with one that had been erased, and the removed cartridge is translated by a special translation system. Although the magnetic tape recorder is more expensive than the electromechanical demand meter, the value of the resulting time-related information provided by these recorders offsets the increased product expense.

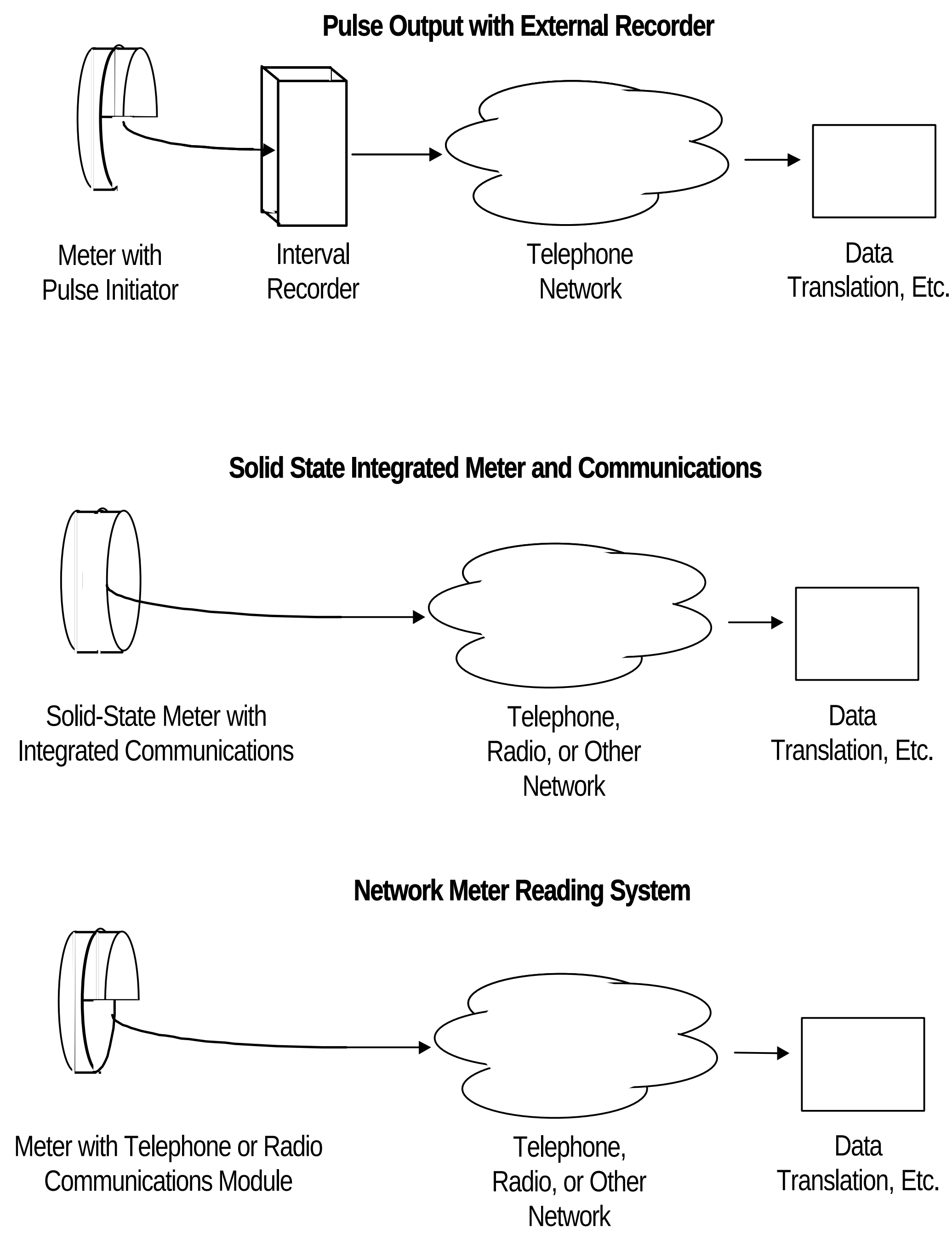
Solid State Interval Recorder

The solid state interval recorder was designed to electronically provide time, date, and non-volatile memory functions. This new device could electronically perform the interval metering function, in a manner similar to the electromechanical recorders. The recorder would save pulses generated by a meter equipped with a pulse initiator, automatically keeping up with time and date, and not requiring the removal of any cartridges.

These electronic recorders also had two modes of communication:

1. Optical Port - utilized by an optical probe and hand held reader that could read the data stored in the recorder.
2. Modem (internal or external) - connecting the recorder to the phone system, which would allow remote communication.

Illustration of Various Metering Configurations



3.2.3 Hybrid Meters

The introduction of electronic registers into electromechanical metering increased the functionality of metering by offering new provisions such as Interval Metering and Time-of Use measurements. Meters with electronic registers provided more energy usage information to the utility, and allowed the utility more flexibility in rate design and system planning activities. Since the electronics were internal to the meter, no external recorders were required. The cost of these hybrid meters was less than the combined costs of the meter and recorder while providing even more functionality.

3.2.4 Solid State Meter

The solid state meter replaced the electromechanical portion of the hybrid meter, making the full meter electronic, thereby eliminating all moving parts.

3.3 Advanced Meters

An advanced meter of today can be defined as a solid state meter that typically performs more than traditional energy and demand metering. An advanced meter may provide:

1. Reactive measurements.

2. Interval data and Time-Of-Use functions.

3. Measurement and display of per phase information, which includes voltage, current, power factor, phase angles, total harmonic distortion, and per phase voltage and current harmonics.

4. Site diagnostics that monitor the meter site and determine if it is wired correctly and if the voltage and current vectors are all within amplitude and phase angle limits.

5. Power quality monitors that look for conditions such as voltage sags, undervoltage, overvoltage, low current, power factor, reverse power, and log in anomalies with time and date stamps.

6. Class consolidation, form consolidation, function consolidation, and wide range voltage capabilities, which reduces the number of meter types needed to correctly monitor a variety of service configurations.

7. Outage and tamper detection.

8. Capability to interface to Automated Meter Reading (AMR) Systems.

3.4 The needs for increased functionality

Metering technologies have evolved because additional information is required to generate, transmit, distribute and consume electricity efficiently and effectively. Industry restructuring will continue to demand more information that can be captured and transmitted quickly and accurately.

It is expected that in an unbundled metering environment, Meter Service Providers will seek to optimize functionality and efficiency through the implementation of one or more advanced metering, communication, and AMR technologies. Advanced metering technologies that are currently available can supply Energy Providers and customers with more information than is typically provided by the installed meter base. The increased information available through advanced metering can also assist Energy Providers in tailoring products and services for their targeted markets and customers.

Advanced metering options are also driven by the requirement that more and more data has to be captured and transmitted more frequently. The data is not just the traditional metering information required to generate a customer bill, but power quality and system performance information that both the T&D Utility Co. and the ESCO's will need to operate more efficiently and effectively.

It is important to note that all meter-related technologies are going through a period of rapid development. Retail access is creating a greater demand for advanced metering. It is also important to note that currently no single solution for advanced metering meets the total needs in any given service territory. An advanced metering system can be a hybrid solution designed to meet customer and system needs at optimal costs. Large scale advanced metering implementations will almost always include a mix of technologies.

3.5 Metering Options

Today, the installed base of meters for the majority of residential and small to medium commercial customers consists of electromechanical watt-hour meters, with electromechanical registers. It is possible to increase the functionality of the installed base through retrofitting meters with modules that can store and transmit readings.

Deciding whether to retro-fit or to replace is not a straight forward decision. The following factors should be considered:

- retro-fit module costs
- retro-fit labor costs
- functionality of the retro-fit vs. replacement meter costs
- meter installation costs
- replacement functionality
- direction of system integration.

Some of these modules simply store energy information and the data can be read monthly via radio. For example, the radio module can be read via walk-by, drive-by, or fixed network systems. In general, TOU and Interval Metering functions cannot be provided by the meter directly. Some fixed networks can provide TOU and Interval Metering functions at a higher level in the system.

Due to industry restructuring, and the need for all entities in the market to operate more efficiently and cost effectively, the overall direction of the metering system must be carefully considered by all parties. Installing a technology that will not accommodate future system requirements can result in technological obsolescence that may eventually require partial or total replacement of the network.

Modules that were developed for Radio AMR systems can be installed in new meters or retrofitted in some older meters. Economic evaluations should be performed to help determine which meters can be retro-fitted, or whether a new meter with advanced functionality could be installed with the communications inside the meter.

However, there is no technology that can be retrofitted onto an older meter that can match the total functionality of today's advanced meters. Functionality, communications, economics and the overall direction of the energy provider will dictate retro-fitting vs. replacement.

A careful decision for advanced metering would include the following:

1. The required metering functions must first be determined,
2. The direction of the overall metering system must be determined,
3. The product and communication technology that best meets the overall requirements of functionality and economy can then be selected.

3.6 Communications Options

Developments in communications technologies have allowed for more efficient programming and meter reading. This section will describe a variety of communication technologies, including visual communications.

3.6.1 Mechanical Dial Indicators

Some meters have mechanical dials that can be visually read.

3.6.2 Liquid Crystal Display (LCD)

The LCD (Liquid Crystal Display) located on the front of the meter will scroll the various metering quantities, and the meter reader can record the information. It requires a meter reader to physically visit the meter and allows the customer or any market participant to visually read the meter. However, display information and sequences may vary. Interval data and other metering information such as Power Quality Monitors cannot be acquired via the LCD because of the large amounts of data that are stored inside the meter.

If the meter is connected into a communications network, and the meter cannot be read for some reason, the LCD, or the optical port described below, are the two most typical methods to read the meter.

3.6.3 Optical Port

Solid state and hybrid meters have an optical port located on the front of the cover that can be used to program and read meters. This optical port is the basic method in programming and completely reading the meter. The optical port is also the basic method to retrieve all information from the meter. To read a meter, the meter reader visits the meter, connects an optical probe onto the optical port, and retrieves the data with various hand-held readers or computers.

If the meter is connected into a communications network, and the meter cannot be read for some reason, the LCD or the optical ports are the two most typical methods to read the meter.

3.6.4 Telephone

Meters can be equipped with internal modems that connect directly to the telephone system with a dedicated line, shared line, or a private telephone exchange such as at a business. The current estimated price for standard telephone modems is in the range of $50 to $300. They also may be equipped with an RS-232 or RS-435 module that interfaces an external modem to the meter (These communications protocols are defined later in this section of the report). The current estimated price of an RS-232 or RS-435 module ranges from $100 to $250. The meter reading system may call the meter to establish communications, or the meters can be programmed to call the meter reading system at a predetermined time or window of time.

A **shared telephone** line is a line that was installed for normal telephone service at a residence or business that is also used for meter communications. The modem usually has Off-Hook Detect and Intrusion Detect. Off-Hook Detect applies when the meter is making the call, and it checks the line to make sure no telephones are in service before making a call. Intrusion Detect applies to all calls to or from the meter. If the modems detect that a telephone was activated, the modems hang up and restore the dial tone.

A shared telephone line is the least expensive telephone method to read a meter since the line was installed for telephone use, and the meter reading is a secondary use of the line. If a shared line is not appropriate, a dedicated line may be necessary. The current estimated price of a dedicated line can range from $10 to over $100 per month, depending upon location, distance, and line availability at an exchange.

Telephone is a two-way communications technology, which means that certain meters can be programmed, as well as read, via telephone.

3.6.5 Cellular

Meters can come equipped with cellular modem modules that connect directly to the transceiver of a Cellular phone. Meter reading systems may call the meter to establish communications, or the meters can be programmed to call the meter reading system at a predetermined time, or window of time.

Cellular meter reading costs vary due to the number of cellular locations, the length of the cellular contract, and the length of the meter reads. Current estimated prices can range from $5 to $20 per month with a multi-year contract and dozens of cellular locations. Costs may be considerably higher, however, when based upon data transmission time plus a monthly, or per call basis. The current estimated prices of cellular modems range $200 to $400 each.

Cellular is a two-way communications technology, which means that certain meters can be programmed, as well as read, via telephone.

3.6.6 Private Communications Service (PCS)

Meters can come equipped with modules that connect directly to the transceiver of a PCS phone. Meter readings systems may call the meter to establish communications, or the meters can be programmed to call the meter reading system at a predetermined time or window of time. Costs vary depending upon the number of PCS locations, the length of the PCS contract and the length of the meter reads. Current estimated prices can range from $5 to $20 per month with a multi-year cellular contract and dozens of PCS sites. Current estimated prices of PCS modems range $200 to $400 each.

PCS is a two-way communications technology, which means that certain meters can be programmed, as well as read, via telephone.

3.6.7 Cellular Digital Packet Data Modems (CDPD)

Meters can come equipped with modules that connect directly to a CDPD modem which must be supported by a cellular network. Meter reading systems call the meters to establish communications, or the meters can be programmed to call the meter reading system at a predetermined time, or window of time.

The current estimated price of CDPD modems can be over $300, plus the monthly cellular charge and the costs of the transmission time.

CDPD is a two-way communications technology, which means that certain meters can be programmed, as well as read, via telephone.

3.6.8 Cable

Meters can come equipped with modules that connect directly to a cable modem, that is connected to the cable network of the type that delivers television signals to homes and businesses. Meter reading systems may call the meters to establish communications, or the meters can be programmed to call the meter reading system at a predetermined time or window of time.

The current estimated price of cable modems is about $250 each. In addition, the cable company may charge other monthly fees such as the costs of transmission time.

Cable is a two-way communications technology, which means that certain meters can be programmed, as well as read, via the cable infrastructure.

3.6.9 Power Line Carrier (CEBus/LonWorks)

These are power line carrier systems that are typically used in the home or a small industrial site. The meter comes with a special module that allows communications directly on the power line. Communications are usually limited to several hundred feet. This technology can be a two-way technology, which means that the meter can be programmed, as well as read. The infrastructure to support power line carrier must be installed at an additional cost. The estimated price of power line carrier modules are somewhat higher than standard modems.

3.6.10 Satellite

The meter is equipped with a satellite communications module that can communicate with Low Earth Orbiting satellites. The company holding the satellite frequency performs the reads, and forwards that information on to the ESP. This is presently a one way system which means that the meter can only be read. Due to the small number of LEO satellites presently orbiting, the reads are limited to certain times of the day.

The current estimated price of a satellite module is in the $400 range, plus the price of each read per meter, which is currently in the range of $10 to $20 per read.

3.6.11 Fiber Optics

Meters can come equipped with modules that connect directly to fiber optic converters which must be directly connected to a fiber optic network. Meter readings systems can call the meters to establish communications, or the meters can be programmed to call the meter reading system at a predetermined time or window of time.

The current estimated price of fiber optic converters is in the $1000 range. The infrastructure to support fiber optics must be installed at an additional cost.

Fiber optics is a two-way communications technology, which means that certain meters can be programmed, as well as read, via the fiber optic network.

3.6.12 Radio Frequency (RF) Modules

There are RF modules that can be mounted in an electromechanical or a solid state meter and that will communicate meter data to a network. RF modules typically transmit energy consumption, but in some systems, the network can provide higher functionality meter data (e.g. interval data and outage alarms).

The current estimated price of RF modules is in the $40 to $100 range. Other costs include network costs, either by owning the network, leasing the network, or purchasing subscription services over some extended contract period. If the network does not exist, infrastructure must be installed at additional cost

RF modules are often one way, but some may have limited two way capabilities.

3.6.13 Wireless Modems

Meters can come equipped with modules that connect directly to a wireless modem. These modems allow operation in a manner similar to a local area network (LAN) used to interconnect remote computers. A radio link to a fixed network replaces the hard wire connection such as a telephone line. In these cases, the modem is on line at all times, and data is transmitted in short bursts. This allows a lot of data to be transmitted over a short period of time to reduce communication time.

The current estimated price of a wireless modem is in the $250 to $500 range. Other costs are network usage charges. Wireless modem is a two-way communications technology, which means that the meter can be read, as well as programmed. If the network does not exist, infrastructure must be installed at additional cost.

3.6.14 RS-232

RS-232 is a communications protocol that defines signal levels and hardware configuration. RS-232 is the interface technology to many communication technologies. The current estimated price of RS-232 modules is in the $100 to $250 range, depending upon functionality.

3.6.15 RS-485

RS-485 is a communications protocol that defines signal levels and hardware configuration. RS-485 is the interface technology to many communication technologies. The current estimated price of RS-485 modules is in the $100 to $250 range, depending upon functionality.

3.7 Automated Meter Reading Solutions

3.7.1 Introduction

The traditional motivation for pursuing automated meter reading technologies has been to control and reduce operational costs. With the advent of telecommunications industry restructuring and technological innovations in remote communications, AMR systems now provide several opportunities for new revenues.

Automated meter reading systems may provide important incentives in competitive energy markets. Besides providing the ability to remotely read meters, AMR systems potentially can provide the following services:

- Outage notification
- Remote meter connect and disconnect [1]

[1] Requires proper switches, which are currently in the range of $200 to $300 per meter

- Detection of some meter tampering
- Time-of-use metering
- Reduction of labor costs for manual meter reads.
- Reduction of labor costs for meter re-reads
- Electronic access to hard-to-read meters
- Elimination of estimated readings
- Collection of profile and load survey information (monthly, daily, or near real time). More frequent reads increase communications costs.
- Implementation of innovative rate structures

Additional services that market participants may offer in the future through AMR systems include;

- forced-entry alarms
- low-or high temperature alerts
- flooding and medical alarms.

These additional services may require additional infrastructure.

3.7.2 Economic Considerations

The economic case for an Automatic Meter Reading (AMR) system is enhanced if data must be recovered from a customer's premises more frequently than monthly.

3.7.3 Network Solutions

All communication technologies, other than optical or visual, require some kind of a network to bring the data from the meter back to the system. Telephone, Cellular, PCS, CDPD, Cable, Satellite, Radio, and Fiber all require some kind of a fixed network that may include switches and land lines, towers, satellites and ground stations, or the power line. These networks may be described as "general use" or "dedicated" networks.

A **general use** network, often informally referred to as a "public" network, is a common carrier (such as a telephone network, cellular network, etc.) that may transmit a wide variety of data for a wide variety of customers, carrying each customer's data separately and securely. Data passed through this type of network is typically not processed, although there may be data processing capabilities and services offered within the network.

A **dedicated** network, often informally referred to as a "private" network, is a network built principally to accomplish a specialized task. These networks may also offer services that pass data through without processing, and may offer broad accessibility to those services. Dedicated networks may serve a single customer or multiple customers, carrying each customer's data separately and securely.

There are some whom believe there are not clear definitional lines between so called "public" and so called "private" networks. There are networks that may have characteristics of both.

Fixed network AMR systems deserve special discussion because of radio networks' present ascendance in the market and apparent potential to fulfill many needs. Meters used in fixed network systems fall into two general categories:

- "Dumb" meters
- "Smart" meters

The "dumb" meter has a minimum of local intelligence. It simply transmits pulse counts or current energy readings to the network. This approach depends upon "intelligent" network elements higher up in the communication hierarchy to perform the data processing, accumulation, and time tagging to produce the required data.

"Smart" meter systems do not require an intelligent network tailored specifically for the meter units. These systems generally can operate through existing public networks for data transport to the energy provider.

One important factor in considering AMR solutions is the structure and geographic density of the customer base served by the solution. Is the customer base residential or commercial and is the customer base spread out over a wide geographic area? Because available "dumb" meter AMR approaches use dedicated networks for added functionality, they require a certain density of metering points per square mile to be cost justified. For widely dispersed metering points, the cost of the dedicated network becomes prohibitive. A significant consequence then, of an open metering environment—in which many business entities may be performing separate metering in a given geographic area—is the dilution of customer density.

3.7.4 Network Meter Reading

Network Meter Reading (NMR), a subset solution of AMR, refers to any AMR approach in which meters are connected to a communications network, thus enabling meter reading at any time. NMR typically refers to networks or devices optimized for metering and meter communications. NMR specifically excludes automatic meter reading that does not include a network, such as meters that transmit to a receiver in a vehicle that passes the meter once a month. Such technology does not enable hourly metering

The following describes alternative NMR solutions using transparent and dedicated-based network examples and proposes a set of criteria for evaluating NMR solutions and their ability to address today's market needs.

Transparent NMR: Meter reading using publicly accessible networks as a communications infrastructure. These networks are nationally deployed and have many users in multiple industries.

Dedicated NMR: Meter reading using dedicated networks for a specific task in a specific industry and regionally deployed.

The range of NMR solutions is determined by applying an appropriate technology to a specific market. These solutions include:

- A blanket network deployment to all meter points.
- A parachute network deployment based on service requirements of targeted customers.
- A hybrid solution comprised of both blanket and parachute deployments.

NMR solutions should:

- Enable competition and customer choice.
- Allow market entry of interested and qualified players into existing franchises.
- Apply to both residential markets and commercial and industrial markets.

As a result, no single technology is appropriate for every customer, market segment, or meter point. A final consideration for NMR solutions is that the energy market is demanding an increase in both quantity and quality of meter data.

3.7.5 Risk Assessment and Criteria

The technological alternatives should be evaluated for risks. These risks fall into three categories:

Commercial Risks

- Appropriateness for all markets and segments (both commercial & industrial and residential)
- End-user acceptance of intrusive technology (i.e. shared phone lines versus dedicated phone lines)
- Accommodates innovation and introduction of new technologies
- Network operational stability
- Accommodates increasing demands in the **quantity** and **quality** of data

Financial Risks

- Customers or capital investors to provide network infrastructure investment (certain network costs are passed down to customers in rate base)
- Financial stability of network carrier
- Total costs of ownership
    - Initial investment costs (hardware and software costs)
    - Network deployment costs
    - Meter installation costs
    - Recurring operational and maintenance costs
    - Economic parameters
    - Risk increases as payback or lease period increases
    - Dedicated or shared network investments
    - Buy network versus lease network services

Technological Risks

- Network experience of operator
- Network data capacity
- Potential for technology obsolescence
- Limited by single or multiple technologies

Performance Risks

- Ability to obtain consistently accurate data

4. Open Architecture

4.1 Summary

Open Architecture refers to the documentation and publication (standardization) of system parameters that are critical for third party implementation of selected system functions. The model developed by Working Group 2 is "open" at three critical points:

- the Meter Reading function output;
- the Meter Data Translation function output; and
- The Customer Association, Validation, Editing and Estimation (CAVEE) output.

Applicability of Open Architecture
The results of analyzing a system containing these functional components leads to the following conclusions:

- **The wide range of functions and implementations of those functions at the meter level presents significant obstacles to standardization.** Even if the existing metering function were fully standardized, a rapidly changing technology could make the standards obsolete before they have been fully implemented. Forced standardization could result in slowed development of new technology with increased development costs and a series of requirements which would become difficult to maintain. Standardization at this level is not necessary for competitive services to be developed. Rather, over time, de facto standards will emerge and remain prevalent until such time as technology or circumstance cause the industry to revisit them. Today's infrastructure is characterized by considerable competition in the supply of meters and meter support systems. Most of these meters and related systems are not compatible with their counterparts from other manufacturers.

- **The model can be standardized without stifling innovation and development of new products.** The functions performed by meter reading, meter data translation and CAVEE systems are sufficiently stable to ensure that there will be minimal change in the future. Since these functions are not presently offered competitively, interfaces between the functions have not yet been developed. This provides an opportunity to develop new interfaces which can be sufficiently relaxed to allow development in the future, and sufficiently restrictive to ensure that third parties can provide these services without fear of incompatibility.

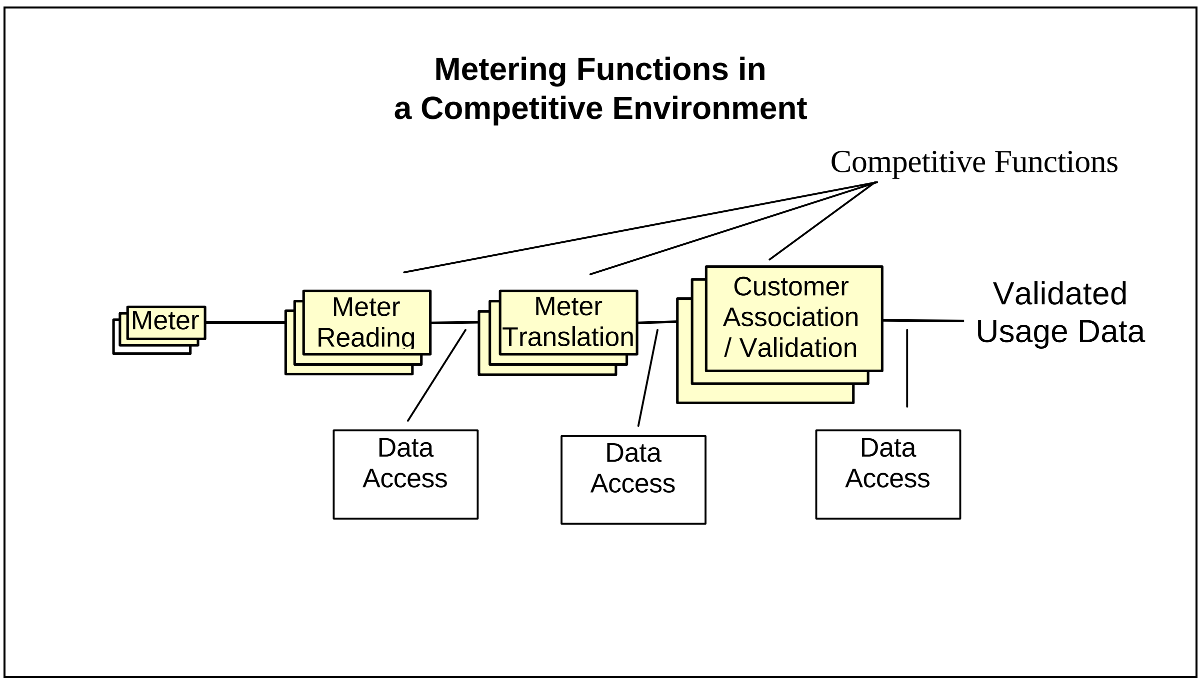
- **Standardization of all parts of the model except for the meter and its interface would allow the integration of presently installed meters into new systems.**

4.2 Overview of Open Architecture Functions

To visualize opportunities for Open Architecture within the metering infrastructure, it is helpful to break the system into functional blocks, define the functions performed in each block, define the interfaces between blocks, and determine the practicality of standardizing each function and interface.

Metering Infrastructure Functional Blocks

For the purpose of this analysis, the metering infrastructure was segregated into four functional blocks: the meter, the meter reading system, the meter data translation system, and the customer association and validation system. The following diagram was developed to show the high level interconnections between the functions.



1. The **Meter** provides measurement of customer energy consumption and communicates the resulting data through a visual or electronic communications interface. It may also receive data from authorized parties to modify internal operating parameters when changes are required.

2. The **Meter Reading** function collects the data produced by the meter, either visually or through an electronic communications interface, and provides that data to authorized parties.

3. The **Meter Data Translation** function takes data from the meter reading system, performs rudimentary analysis to remove data needed for billing, and sends that data to authorized parties.

4. The **CAVEE** function takes data from the meter data translation system and associates it with a specific customer. The resulting data are validated against a set of rules which are designed to ensure that the data are reasonable. Data from this function are used for billing the customer.

4.3 Detailed Discussion of Open Architecture

Open architecture has often been presented as a solution for all of the incompatibility issues which exist in metering infrastructures today. In order to address the potential benefits and drawbacks offered by this approach to incompatibility, the following provides definitions for Open Architecture, describes the metering infrastructure for which Open Architecture issues will be examined, and provides recommendations concerning application of Open Architecture principles to that infrastructure.

4.3.1. Definitions and Characteristics of Open Architecture

a) A system has Open Architecture when its operating parameters have been defined in the public domain.

Public domain definitions are the publication of standards describing the operating parameters that will provide sufficient information to allow a third party to interface with the system. Communication protocols, data structures, physical interfaces, and electrical interfaces are examples of operating parameters.

Working Group 3 is using a less restrictive, but still operational, definition which provides for operating parameters to be available, but not necessarily public. Publication of operating parameters to a selected group of market participants allows development of open systems by authorized parties without forcing public disclosure of parameters. System security may be enhanced by restricting access to parameter definitions to authorized parties.

b) **Implementation of systems with *totally* open architecture is rarely possible.**

Fully open systems require total standardization and documentation of all system parameters. Standards frequently do not exist for all system parameters. Development of standards is expensive and slows product development, which can serve as a disincentive to developing totally open architecture.

c) **Open Architecture becomes critical when a system is to be segregated into its individual functional elements, with each of those elements being performed by a different entity.**

The standardization of the functionality of the elements is required to ensure overall system performance. The standardization of interfaces to each element is required in order to ensure compatibility and communication with other elements. Complete standardization eliminates system redundancy and simplifies the design of interfaces between system elements.

A segregated system which does not incorporate fully open architecture may have redundancy of function and unnecessarily complex interfaces between elements.

d) **The full benefit of Open Architecture can be gained only when system parameters are available and all implementations of the same system functions use the same sets of standards.**

In metering systems, multiple standards exist for both communications and metering functions. If every function and system interface utilizes the same standards, then full benefit of an Open Architecture will be achieved.

4.3.2 Open Architecture Functional Elements in the Unbundled Model

The metering infrastructure can be segregated into a series of functional elements which interface with each other through the transmission of data. The following diagram, which is the model of unbundled metering services developed in Working Group 2, illustrates those functional elements and their interconnections in an environment where the individual functions can be offered as competitive services. Open architecture for each functional block is described below.

a) **The meter provides measurement of energy usage at a service end point.** The physical interface from the service to the meter is a socket (for residential and small commercial) and either socket or direct wired for larger accounts which use instrument transformers. The data interface to the meter is either visual (display) or a communications port (RS232, Telephone, Radio, Optical Port, etc.) The data interface from the meter to the meter reading system has the following characteristics:

Data available here are raw (unprocessed) and constants needed for billing have not been applied.

The protocol and structure of the data available at the meter are highly dependent on the meter type and manufacturer.

The data interface may need to be bi-directional to allow updating of meter operating parameters.

Security to limit access to data directly from the meter is limited to basic password protection and the protocol requirements of the meter. This provides considerably less security than is possible in other parts of the system where significantly more storage and processing power is available.

Since the meter typically cannot handle more than one communication session at a time, ensuring timely access to an authorized user is more difficult when more than one user is authorized.

b. **The meter reading function retrieves data from the meter and delivers it to the translation function.** This function provides an association between retrieved data and meter identification. It also provides detection of site metering irregularities and allows for the update of meter parameters. The data interface to this function from the meter is highly dependent on meter type, meter function, and meter communication method. The data interface from this system to the translation function has the following characteristics:

Data are raw (unprocessed) and constants needed for billing have not been applied.

Data are indexed by meter identification and not associated with the customer account.

The protocol and structure of the data are highly dependent on the meter type and manufacturer. Standardization of this interface may be accomplished by encapsulating the data in a standard format for transmittal to the translation function where the device dependencies can be removed.

c. **The Meter Data Translation function receives data from the meter reading function in a format based on meter type, associates that data with a specific meter type, checks for errors in the resulting data stream, extracts data appropriate for billing, and provides device-independent results for the CAVEE function.** This function may often be found bundled with either the meter reading function or the CAVEE function. The data interface from this system to the CAVEE function has the following characteristics:

Data are unprocessed and constants needed for billing have not been applied.

Data are indexed by meter identification and not associated with the customer account.

The protocol of the data is well defined and independent of meter type.

Additional outputs may be made available for device-specific functions. These outputs will be associated with the meter identification and will be in a format dependent on meter type.

d. The CAVEE function takes usage data from the Translation function, associates it with a customer (summing inputs from multiple meters where necessary), validates the data against prior usage and typical patterns, and provides processed data to billing systems. The data interface from this function to the Billing function has the following characteristics:

Data for accounts metered with more than one meter have been consolidated.

Data available here have been processed. They have been associated with the customer, have had all constants and multipliers applied, and have been validated. The protocol and data structure are functions of the entity maintaining the database. Variations based on meter manufacturer and communications channel have been removed.

4.3.3 Application of Open Architecture to the Meter

As meters are currently designed, they are not readily suited to the application of Open Architecture standards. Some of the reasons include:

- Modern meters have a wide variation in functionality and communication ability. This variation makes consensus on standards for interface and data storage difficult to achieve, placing significant obstacles in the path of fully open systems.
- Attempts to standardize the meter data interface and meter data storage protocol have left room for device specific functionality, diluting many benefits that may be reaped from full standardization.
- Fully open systems may not be possible at this level. Minor variations in functionality and implementation of standards may require translation systems, even in the most open systems.

4.3.4. Application of Open Architecture to the Meter Reading Function

- Since this function deals with meters directly, it must be capable of handling data in whatever form (and quantity) produced by the meter.
- The interface of this function with the translation function can be standardized by encapsulating the data in a common protocol and associating that data with a meter identification.
- The exception-handling output interface of this function can be standardized by assigning exception codes on a statewide basis, and associating them with a meter identification and comment field.
- The meter data input to this function can be standardized to ensure that the identification of meter type (needed for interfacing with the meter) is consistent regardless of who supplies this information.
- Meter data requirement dates, meter locations, and special customer instructions may also be supplied through a well defined interface.
- Updates to meter table data must be specified to this function through an interface which encapsulates the table data, identifies the meter protocol and password, and associates it with the meter identification.

4.3.5 Application of Open Architecture to the Translation Function

- The Translation function, by its definition produces a standard format which outputs to the CAVEE system.
- In a system where multiple translation systems coexist, further standardization must exist to ensure that all systems produce the same output format for billing parameters.
- Output of meter specific data from this function can be standardized by encapsulating the data and associating it with a meter identification.
- The meter data input to this function can be standardized to ensure that the identification of meter type (needed to properly translate the meter data) is consistent regardless of who supplies this information.

4.3.6 Application of Open Architecture to the CAVEE Function

- If the Translation function is properly specified and implemented, then the Validation and Customer Association function should receive translated data in a standard manner.
- Customer data input to this function can be standardized to ensure that all information needed for validation and association is consistent regardless of who supplies the data.
- Output of the CAVEE function must be fully open to open to allow all authorized parties to use the data processed here.

4.3 Conclusions

Working Group 3 believes that the fullest practicable implementation of Open Architecture is needed to most effectively implement the competitive metering model. At present, this means the functional elements of the model that must employ Open Architecture begin at the meter reading output interface and continue through the CAVEE output. In current industry meter implementations Open Architecture is not practicable at the meter level, but that does not present a barrier to implementing the model. If the meter industry adopts a true Open Architecture standard, allowing increased meter interoperability, that might add efficiencies and help to lower metering costs and prices.

Even without standardization at the meter level, the level of Open Architecture in the model permits the development of a competitive metering services market. In an unbundled environment, multiple meter reading and meter support companies can exist, each with an ability to support certain devices and certain functions. If the interfaces to those entities are well defined, then the end user of the metering data could simply choose the supplier who provides the service appropriate to the account being monitored. Since these services have not been offered competitively, making them so would have to be accompanied by definitions of functionality and interface protocols. If Open Architecture is defined by market participants statewide rather than on a T&D utility level, the resulting infrastructure can facilitate data exchange among the market participants.

5. Technical Performance Standards

5.1 Context for Technical Performance Standards for Competitive Metering

Standards for technical performance of meters are required to ensure accuracy and reliability of meter data, as well as the safety of personnel and customers.

5.2 Principles for Establishing Performance Standards

In agreeing on technical standards, three principles should apply:

1. National standards should be adopted when available.
2. Mandatory standards, i.e. PSC requirements, should be kept to a minimum and used only when absolutely necessary to guarantee metering accuracy and the integrity of the market, as well as customer and employee safety
3. Whenever possible, mandatory standards should impose the least possible cost on all market participants.

5.3 Standards for Meter Performance

The California CPUC adopted a set of interim meter performance standards on December 3, 1997 in Decision 97-12-048. Appendix C briefly summarizes some standards contained in that order. Further development of meter and meter data standards in California was done in 1998 by the Permanent Standards Working Group.

Working Group 3 does not propose specific standards in this report, and makes no recommendation regarding their applicability to the model developed by Working Group 2. Development of standards for the competitive metering environment is an important follow-on activity, however, so the standards areas included below should be considered by any follow-on working groups in this area.

- **ANSI Standards**

  The ANSI C12 family of standards addresses a variety of meter characteristics, and are generally, but not always, implemented nationally. ANSI C12.19, which concerns meter data tables, is one standard that is not universally adopted by manufacturers.

- **Meter Performance Standards**

  These standards address items such as minimum data storage periods.

- **Managing Meter Data**

Meter data management performance standards are necessary to ensure timely collection and delivery of data and to ensure that meter reads are accurate and valid.

- **Meter Read Schedule**

The meter read schedule defines the general timing and conditions for establishing meter reading. The Group 2 model assumes most meters will be read monthly, but allows for other schedules to be established.

- **Data Timeliness and Availability**

These standards are used to establish the time and availability requirements for acquiring and posting validated meter reading data on a the server belonging to the CAVEE entity for retrieval by authorized parties. They include standards for:

- Interval Data:
- Non-Interval (Monthly) Data:

The standards also address issues such as:

- how quickly data must be provided from the Meter Reading Provider to the Translation and CAVEE functions;
- how much rolling history should be maintained on the CAVEE server for each customer;
- mechanisms and protocols for data transfer; and similar issues.

- **CAVEE**

CAVEE standards can provide for consistent application of editing and estimating rules for all market participants, through the systematic application of rules agreed upon by market players. Some subjects for CAVEE checks are:

- Interval data validation;
- Monthly data validation;
- Estimation rules for linear interpolation and use of historical data.

Other standards will be developed as identified by a follow-on stakeholder working group.

6. Service End Point Identifiers (universal id's)

6.1 Introduction

One concern on the implementation of both Retail Access and competitive metering services is the ability of all parties to identify Service End Points (SEPs) on any given T&D Utility system. The Service End Point is not the meter but a point on the T&D Utility system where a meter may be connected to measure service. The SEP Identifier (SEP ID) is a unique, permanent number assigned to each SEP participating in Retail Access and used for data exchanges and service end point tracking.

Currently, New York utilities each use a unique system of identifiers, described in Appendix D. SEPs are identified in meter/site configuration databases, which are maintained by the T&D utilities. However, as retail access develops and the competitive metering model is potentially implemented, various market participants may each have a legitimate need for SEP information. Some of these entities may operate in more than one T&D Utility service territory, or even across jurisdictions. In such cases, a Universal Identifier may facilitate proper identification of Service End Points no matter where they are located, or which entity is providing the service.

Working Group 3 agrees that the SEP Identifier is not required for competitive metering but SEP IDs may have value and should be investigated further as a follow-on item.

6.2 Current Utility Identifiers for Service End Points

In the present meter reading infrastructure of New York utilities, Service End Points and meters are identified and controlled by utilities as an internal utility function. Each utility developed its own systems over time to identify these points. There was no need to design identification systems common to all utilities since the identifications were not meant to be shared outside the utilities. As a result, the utilities currently use widely varying customer, SEP, and meter identifiers in their information systems, some of which are used in tracking direct access customers. Appendix D describes key identifiers used by the utilities; it is not a comprehensive listing.

6.3 Service End Point: Universal Identifier Approach

The Working Group believes a universal identifier system can be a desirable element of a competitive electric market. It can facilitate tracking energy transactions, reduce transaction costs, reduce system development costs, and achieve other essential benefits. The benefits must be viewed in context with the costs of implementing SEP IDs.

Appendix D contains an approach that can form the basis for further investigating the development of a common system of SEP Identifiers. The approach does not require the T&D utility to make changes to their existing databases for service end points identifiers, such as control numbers, site numbers, etc. The T&D utility may create such links using translation tables, so the SEP IDs are not contingent upon the T&D utility working out any problems that may exist within their existing SEP numbering systems.

Definition: The SEP is the last point of the T&D utility's distribution network and to which energy is delivered by the T&D utility

SEP ID Characteristics

1. **Unique.** Every SEP ID would be unique to avoid duplication and ensure appropriate responsibility for provision of energy services.

2. **Permanent**. The SEP ID would be permanent and unchanging for the service life of the SEP to create an audit history, including ensuring a continuous record of ESCOs providing service to that SEP.

3. **Use.** The SEP ID must be used for exchanging data about Retail accounts.

4. **Assigning Entity**. The T&D Utilities are the preferred entities to assign SEP IDs.

5. **Assignment Process.** Upon enrollment, and retroactively for those already signed up in the beginning stages of Retail Access, a SEP ID will be assigned automatically to each SEP.

6. **Base Format**. In order to accommodate existing T&D Utility systems, the SEP ID would have a flexible field length. A possible characteristic may include a geographic code which would aid market participants in identifying the T&D utility, in addition to the identifiers used by each T&D utility to internally identify Service End Points.

7. Provider of Last Resort Concerns

The Commission determined in Opinion No. 97-5 that, at least during the transition to competition, the incumbent utilities will be the “provider of last resort” (POLR) for electric energy service. The working group believes that nothing in the competitive metering and billing model is a barrier to the POLR requirement for electricity service. This is accomplished by the requirement under the competitive metering model that all meters do and will have a visual read capability. Therefore, even with higher functionality meters with remote read capabilities, the meter will be visually readable for billing purposes.

We note that some parties believe open architecture standards should also be applied at the meter level to assure that the POLR could read the meter with minimal changes to its existing meter reading system. There may be value in working towards a future level of standardization that would allow more meter interconnectibility, but this may not be practicable within the immediately foreseeable future.

8. Follow-on Work Needed

While Working Group 3 believes that a workable model for competitive metering has been specified at a high level of organization, we also believe that there are several follow-on tasks that must be completed to make a competitive metering system a functioning reality. In general, these follow-on tasks will be best performed by groups similar to the ESCO Metering Subgroups: i.e. the implementation work groups should consist of representatives of a broad variety of stakeholders. The implementation groups however, will for the most part concentrate on mechanisms to implement policy growing out of these Working Group recommendations and final PSC decisions. These groups will likely be composed of much more specialized personnel. Other states, such as Pennsylvania, Arizona, California and Massachusetts have conducted specialized working groups, particularly in the areas of Electronic Data Interchange (EDI). Comparable groups concentrating on metering issues in New York should be similarly effective.

The list of follow-on tasks below is not intended to be an exhaustive list. As the metering Working Group reports are finalized we expect that some issues will arise that need further work or have not yet been addressed at all. Some of the issues listed below may coincide with issues addressed by other working groups

The list of follow-on tasks includes:

1. Further specification of technical performance standards.
2. Specification of data formats for open architecture interfaces;
3. Further investigation of the feasibility of Universal Identifiers for Service End Points
4. Periodic review of technology changes in the AMR that may affect the implementation and development of the competitive metering model.

APPENDIX A Contributing Group Members

The following list includes stakeholders who participated in the development of this report.

Member	Organization
Carrie Cullen Hitt	New Energy Ventures
Stephen Berger	NY Consumer Protection Board
Jeff Brown	Enron
Kevin Brocks	CCES
Michael Carver	ABB
Richard Coblens	Schlumberger
John D'Aloia	DPS
Alan Elberfeld	DPS
Barry Goodstadt	Itron
David Hepinstall	Alliance for Energy Affordabiilty
Chris King	CellNet Data Systems
Richard Koda	Local 1-2, UWUA, AFL-CIO
Roy Lokys	Central Hudson Gas & Electric
Ted McClelland	ABB
Larry Nardo	Con Edison
George Roberts	Schlumberger
Mike Prosser	Niagara Mohawk
Mike Sherman	Peregrine Energy Group for CellNet
Joe Sidiski	Con Edison
Andrew Wood	Con Edison
Michael Pagliocca	Orange and Rockland
Bill Mills	DPS
Ralph Luciani	NYSEG

APPENDIX B Glossary of Terms

AMR (Automated Meter Reading) - AMR is a form of advanced (or enhanced) metering that uses communications devices to communicate data from the meter to the utility or (in an unbundled metering services environment) the meter reading or meter data management provider. AMR may be used to transmit simple energy usage data from the meter, or to transmit more complex measures of energy recorded in the meter, or to implement advanced functionality such as outage detection, remote programming of meters by an authorized party, or other functionality.

> **NMR (Network Meter Reading) -** NMR is a type of AMR in which a network is used to collect, transmit and analyze meter data. Some advanced meter functions may be implemented in the network rather than in the meter at the Service End Point.

CAVEE (Customer Association, Validation, Editing and Estimation) - CAVEE is the process in which meter data, which has been translated into a common format, is processed and readied for bill generation and other operations that require validated usage data. In CAVEE meter data are associated with the correct customer through reference to the service provider's database. The data are then subjected to a number of tests for reasonableness, compared to stored usage history and transmitted to billing and other appropriate functions. If data are missing, usage estimations are made according to fixed rules. If anomalies are found error reports are generated.

Interval Metering - Interval metering is the measurement of customer energy usage by fixed time periods or intervals. Typically, the interval time period is 15 minutes, but can vary according to the customer and/or T&D system needs. Today, interval metering is provided to commercial and industrial customers and some residential customers. In the future, in an unbundled environment, the residential market may require more frequent interval measurements.

> **Hourly metering** - Hourly metering is a type of interval metering where the measurement or recording of customer usage is collected in 60 minute intervals. The competitive metering model is based upon the implementation of hourly metering of customers or the application of load profiles, which average customer use over hourly periods.

kVar (kilovar) – The unit of measure of reactive power – the power supplied to most types of electromagnetic equipment, such as motors.

KW (kilowatt) – one thousand watts

KWh (kilowatt-hour) – The basic unit of electric ***energy*** equal to one kilowatt of power supplied to, or taken from, an electric circuit steadily, for one hour. Also known as consumption.

MDSP (Meter Data Service Providers) - In the competitive metering model, an MDSP is an entity that collects, translates and/or analyzes meter data for billing and related purposes.

MSP (Meter Service Providers) - MSPs are entities that physically handle meters for purposes such as installation, maintenance, setting and upgrading internal parameters and removal.

Open Architecture – Standardization, documentation, and publication of system parameters that are critical for third party implementation of selected system functions.

Phasor Diagrams – Diagrams that show all vectors for three phase current and voltage.

POLR (Provider of Last Resort) – Provider of electric service that is required to serve any customer requesting service in accordance with the Commission's consumer protection rules and statutes. The POLR provides service to customers that do not choose an ESCO, customer that choose to leave service from a ESCO, and customers to whom an ESCO will not or can not provide service.

SEP (Service End Points) – Destination points for electric service most often at the meter level, but that could be higher in the chain.

Watts – The basic unit of electrical ***demand*** or ***power***, equal to the rate of energy transfer equal to one ampere flowing due to an electrical force, or pressure, of one volt at unity power factor.

APPENDIX C Proposed California Technical Performance Standards (for information only)

The following are extracted from California Public Utility Commission Decision 97-12-048, December 3, 1997. Some terminology has been altered to be consistent with terms used in New York. This is *not* the complete set of standards ordered by the CPUC. These standards have been neither adopted nor rejected by Working Group 3, but are presented as indicative of the standards being developed in other jurisdictions.

ANSI Standards

Meters should meet the following ANSI standards that apply to the specific type of meter, generally adhering to the ANSI C12 family of standards[2]:

- ANSI C12.1 Code for Electricity Metering
- ANSI C12.6 Marking and Arrangement of Terminals for Phase-Shifting Devices Used in Metering
- ANSI C12.7 Requirements For Watt-hour Meter Sockets
- ANSI C12.10 Electromechanical Watt-hour Meters
- ANSI C12.11 Instrument Transformers for Revenue Metering, 10 kV BIL through 350 kV BIL (0.6 kV NSV through 69 kV NSV)
- ANSI C.12.13 Electronic Time-of-Use Registers for Electricity Meters
- ANSI C12.20 0.2% and 0.5% Accuracy Classes[3]

Where existing certified meters are used, they may be retrofitted with devices for communications purposes. Any such retrofits should adhere to all appropriate published standards. If an optical pick-up type retrofit module is used, the meter should have to pass a sunlight interference test.

[2] The Standards list does not include ANSI C12.19, which pertains to meter data tables. This standard has not been adopted by all meter manufacturers.

[3] This standard has been approved, but has not yet been released.

Meter Performance Standards

Meters used for direct access should meet the following performance standards:

1. The meter or the meter data system must be capable of providing and storing required interval data for a minimum of 35 days.
2. The meter or meter data system must be able to collect data at least hourly when used for hourly metering.
3. The meter must continuously accumulate and be able to display total consumption, plus peak demand and/or kVARh if required by the distribution tariff and if the T&D Utility is the metering provider.
4. Meter accuracy must meet current PSC requirements.

Managing Meter Data

Meter data management performance standards are necessary to ensure timely collection and delivery of data and to ensure that meter reads are accurate and valid., Working Group 3 has addressed this issue, but has not proposed a comprehensive or final set of standards. The standards proposed below should be treated as preliminary as in the previous section, subject to review and refinement by a dedicated working group of stakeholders.

The following standards are recommended:

Meter Read Schedule

Each meter must be read each month as defined by the Meter Reading Service Provider meter reading schedule, unless the settlement process allows for more frequent data collection.

Data Timeliness and Availability

The following standards should be used to establish the time and availability requirements for acquiring and posting validated meter reading data on a the server belonging to the CAVEE entity for retrieval by authorized parties:

- Interval Data:

  1) 80% of all usage data should be available on the first day after the scheduled reading date of the meter.

2) 90% of all usage data should be available within two days of the scheduled reading date of the meter.

3) 99.99% of all usage data should be available within four days of the scheduled reading date of the meter.

- Non-Interval (Monthly) Data:

  1) 90% of all monthly meter readings should be available on the first day after the scheduled meter reading date.

  2) 95% should be available within two days of the scheduled meter reading date.

  3) 99.99% should be available within four days of the scheduled meter reading date.

- The CAVEE Server should contain 3 days of (rolling) read history.
- The CAVEE should keep the most recent 12 months of customer consumption data for each Direct Access customer. This information should be archived for three years
- Meter data should be released automatically to the customer's Energy Provider and, if authorized by the customer, to any other party.
- Meter reading data should be exchanged using the Electronic Data Interchange (EDI) standards adopted by the Utility Industry Group (UIG). These standards are under development, but are currently being successfully employed in several jurisdictions.

Validation, Editing and Estimation (CAVEE)

Validation, editing and estimation should be performed in accordance with current New York practice standards and made consistent across the state. Development of a final set of standards will require additional specification by a stakeholder working group. The tests listed below should not be considered an exhaustive list.

The following tests are required for kWh and kVARh interval data validation:

- Time check of meter reading device/system
- Time check of meter
- Pulse overflow check
- Sum check
- Spike check
- High/low check

- Internal meter identification check

The following tests are required for monthly data validation:

- High/low usage check
- High/low demand check (applies to demand readings only)
- Time-of-use check (applies to TOU data only)
- Zero consumption for active meters
- Usage for inactive meters
- Meter reading dial quantity
- Dial decimal quantity
- External meter identification check

The following estimation rules will apply:

- Less than two hours of missing data: linear interpolation
- More than two hours: use historical or other available data as required

APPENDIX D Utility Identifiers

This Appendix describes:

1. Current identification systems used by some of the T&D utilities; and
2. A specific approach to a SEP ID system developed by one party to the Working Group.

1. Identifier Systems used by New York Utilities for Service End Points, Meters, Customers, Accounts and Premises.

Con Edison

Con Edison has the following identifiers:

1. Meter	prefix = 7 character, number = 7 numeric
2. Customer	= 21 character, overflow = 42 character
3. Account	= 15 numeric
4. Premise	= 25 character
5. Service end point (meter socket or equivalent)	= 4 character

Con Edison uses a combination of the Premise and Service end point to track direct access customers.

Central Hudson

Central Hudson Gas & Electric has the following identifiers:

1. Meter	= 9 numeric
2. Account	= 10 numeric

Tracking of Direct Access Customers is currently handled by a different rate code. This indicates to CHG&E's CIS system that this is a direct access customer. CHG&E also has a cross reference to each ESP displayed on CHG&E's Billing History screen so Customer Service Representatives have this information.

Niagara Mohawk

Niagara Mohawk has the following identifiers:

1. Meter	= 9 character
2. Customer	= 9 numeric
3. Account	= 10 numeric
4. Premise	= 9 numeric
5. Service end point	= 8 numeric

Niagara Mohawk uses a combination of the Premise, Service end point and meter point (4 numeric) to track direct access customers.

NYSEG
NYSEG has the following identifiers:

1. Meter = 8 numeric
2. Customer = __ numeric
3. Account = 15 numeric
4. Premise = __ numeric
5. "Direct Access" = __ numeric

NYSEG uses the "Direct Access" number assigned by DB2 to exchange data about direct access customers with suppliers.

Rochester Gas and Electric
Rochester Gas & Electric has the following identifiers:
(to be included when received)
1. Meter = __ character
2. Customer = __ numeric
3. Account = __ character
4. Premise = __ numeric
5. Service end point = __ numeric

RG&E uses the ______ number to exchange data about direct access customers with suppliers.

O&R has the following identifiers:

1. Meter = 9 digit numeric
2. Customer = 9 digit numeric
3. Account = 10 digit numeric
4. Premise = 9 digit numeric
5. Service end point = 9 digit numeric

O&R uses separate rate codes to identify direct access customers. Customer and premise numbers identify individual customers.

2. A possible approach to developing Service End Point Identifiers

The following sections describe one approach to developing Service End Point Identifiers for the T&D utilities in New York State. This approach was presented to Working Group 3 by one party to the Working Group. The Working Group did not discuss the approach for the purposes of deciding to adopt, modify or reject it.

1. **Geographic Code**. Each SEP ID could include a seven-digit prefix beginning with “10” as a prefix and the five digit DOE designator for the electric distribution utility at the time of SEP ID assignment (this allows the T&D utility to assign SEP IDs – using their own procedures and without having to coordinate with other entities – while also ensuring uniqueness). The “10” provides flexibility for future changes if necessary. Gas or other utilities can use other geographic codes, so this format allows for extension of the format to non-electric utilities.

2. **Total Digits**. The SEP ID will have a minimum of 18 and maximum of 36 digits.

3. **Lists**. The T&D Utility should maintain master lists of all existing SEP ID numbers on their distribution systems and provide to an ESCO a list of SEP ID numbers only for that ESCO upon the ESCO’s request. This information is already planned for by the T&D utility to keep track of Direct Access customers. This is not intended to substitute for the ESCO’s own system to track its customers. It is intended for use in auditing, database synchronization, and ensuring no duplication of numbers.

4. **Links**. The T&D utility will have for each SEP ID, the following information:

   1 - the SEP ID number
   2 - the T&D Utility’s identity
   3 - the physical location of the SEP in the T&D Utility's own format
   4 - the identity of the ESCO responsible for serving energy for that SEP

5. **Translation.** The above-defined SEP ID can be implemented by the T&D Utility via a translation table between their existing numbering system and the SEP ID.