DEMAND SIDE MANAGEMENT CONSIDERATIONS IN ADVANCED NETWORK DEPLOYMENT

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Synopsis

As cable operators contemplate upgrading their cable TV systems to full service networks, one services that may be included in the list is Demand Side Management (DSM), either as a joint venture with an electric utility, or by providing DSM as a contracted service. In this paper, we will examine why an electric utility wants DSM, and how a cable operator may be successful in providing DSM services.

Information presented here is based on MMS's experience in assisting cable operators develop and implement full service networks, and in assisting electric utilities evaluate their alternatives for the installation of DSM networks and services.

❒ 1.0 Defining Demand Side Management

Demand side management is the general term applied to an application that permits an electric utility to communicate with its customers. A demand side management system utilizes a *smart* two-way interactive network linking the power company's command and control center with interface devices at customer locations. These devices monitor and sometimes control power usage. This communications network can also be used by the power company to provide: real time tracking of power usage and outages; meter reading; service connects and disconnects; and, detection of unauthorized service use and meter tampering.

The DSM network can also allow utility customers to make real time *lifestyles* driven decisions regarding their energy utilization levels. Consumers gain control and the ability to make energy consumption choices. The electric utility achieves higher levels of operating performance through the collective decision making of customers who use DSM technology. The result is energy cost savings and higher levels of customer satisfaction, and better financial results for utility company stockholders.

❒ 2.0 Why Two-Way Networks and Demand Side Management Applications Are Important to Utilities

A number of regulatory, competitive, technological, customer, and economic factors are causing fundamental changes in the electric utility industry. Two-way network deployment to end-user locations and demand side management applications are one important way to utilize technology to help deal with these forces and changes.

2.1 Regulatory Factors

A number of important regulatory trends are shaping power company thinking. First is the opening-up of the "grid". This opened-up grid permits large capacity users to purchase their electrical power out of the local power company's service area, and the local power company must provide transport to the user. With this open grid, utilities are brought into direct competition.

Second, is the relaxation of restrictions on end-users from themselves getting into the power generation business (both to serve their own needs and to feed power into the grid). Third

are the strict requirements with respect to environmental impacts and public safety which affect both the cost and time to design and build new power generation capacity. Finally are public sector driven considerations with respect to the efficiency of utilization of non-renewable resources and the cost to the consumer for energy use.

- A two-way network to end-user locations and demand side management applications enable a utility to operate more efficiently in this increasingly competitive environment. In addition, a DSM system can help reduce and/or delay the commitment of substantial capital for new power generation plants. Further, a DSM system can demonstrate to regulators that the utility is responding to calls for higher efficiency.

2.2 Competitive Factors

Increased competition among power generators, wholesalers, distributors, and large retail customers is a reality for utilities. The result is that utilities recognize that they must strive to lower costs, improve efficiency, and/or provide additional services in order to achieve a sustainable competitive position.

- A two-way network for demand side management applications is one of a number of means that a utility can use to strengthen its competitive position.

2.3 Technological Factors

Electric utilities have extensively deployed fiber/digital/two-way networks in order to perform "command and control" functions in the electrical distribution grid. These functions include system monitoring and power generation/distribution adjustment among power stations and various relay and substation points on the distribution network. They also include communications among utilities regarding the purchase and sale of power on the *opened-up* national grid, and the full range of plant management and maintenance functions.

- Demand side management represents a natural extension of this "private network" to end-user locations and thus greater utilization of a telecommunications asset already in place.

2.4 Customer Factors

Overall demand for power is increasing at a modest rate. At the same time, the "consumer power demand profile" exhibits substantial seasonal and daily peaks which, to some degree, are caused by factors like weather which are not within the control of the utility.

Residential customers are highly sensitive to price and, while generally satisfied with power company "service", do not exhibit a great deal of "brand loyalty" to what is perceived as a "commodity" service provider.

Commercial customers are demanding reliability in delivery, and utility responsiveness to problems. Further, large commercial customers have two alternatives with respect to their source of power. The first is construction of their own facilities to serve their needs. Second is purchase of power from an *out-of-region* supplier who, under the more open regulatory framework, can profitably deliver power over the local power company's grid.

- A demand side management system helps a utility build "brand loyalty" by giving customers some control over management of their power consumption costs and direct feedback on how their decisions save them money.

2.5 Economic Factors

Electric utilities face complex and challenging capital and operating issues.

The source of a power company's product is obviously a power generation plant. A power company faces two types of challenges in terms of capital deployment to increase its generation capacity.

First is the utility's response to *long term* increases in the demand for power. That is, bringing a new power plant on line represents a very costly investment (estimated at $1 to $3 billion dollars). The planning, design, and construction process for a new power generation "base unit" is very lengthy -- up to ten years. The regulatory requirements that must be met in terms of safety, the environment, and so forth are one of the factors that add to cost, timeframe, and risk with respect to new plant construction.

Second is the utility's response to the *seasonal and daily* variations in the demand for power. Meeting peak demands requires that the power company build "peaking units" which are brought on line on an as-needed basis. Construction and operation of these peaking units results in under utilization of capital resources and higher cost per kilowatt-hour as these units are not always operated at levels of peak efficiency.

- A demand side management system can help an electric utility operate more efficiently in the short term while having a positive impact on long term capital requirements for new plant construction.

3.0 DSM Network Technical and Operational Requirements

3.1 DSM Network Applications

A Power Company's applications for a demand side management system are based on a general hierarchy of internal requirements. These priorities will vary somewhat from utility to utility, but in the broadest perspective most power companies have the following priorities:

Primary Uses

1. Demand-side management / load control
2. Real time price information
3. Distribution automation capabilities for the electric power network
4. Power outage detection and notification

Secondary Uses

5. Automated reading of electric meters
6. Automated billing
7. Automated service connects and disconnects
8. Detection of unauthorized service use and meter tampering

Ancillary Uses

If a power company installs an advanced DSM network they could also offer:

9. Contracted services to other utilities (water, gas)
10. Security services
11. Information services
12. Cable television services
13. Telephone services

Before cable operators become too concerned that electric utilities are going to build extensive DSM networks and then get into the cable TV and telephone business, it should be pointed out that PUCs, at this point, typically stipulate that utility-customer information networks have to be justified based on savings and revenues from utility related services. Any revenues from non-

utility related businesses cannot exceed 10% of the total revenues from the communications network. More on this later.

3.2 DSM Network Components

How can the identified functions of a DSM network be realized? To address this question, we must first define the components of a DSM system. Broadly categorized, the components are:

- The customer premises communications system
- The electric meter interface
- The communications link between customer premises and the power company.
- The command and control computer hardware and software for desired applications

All of these components contribute to the overall cost of the network with the major cost being in the communications link between the customer premises and the power company.

Many of the peripheral devices such as electronic kilowatt-hour meters and remotely operated disconnects have been developed and some are readily available for purchase. The primary missing link between the power company and its customer is a two-way communication system which has been designed and configured for DSM. Also the hardware and software required to communicate within the customer's premise, and to interface with the electric meter needs more development, but this component will probably evolve into to a workable system before the DSM networks are in place.

3.3 Available Communications Technologies

Parts of the infrastructure which could provide communications between the power company and its customers currently exist:

- Power Companies: First on this list are power companies themselves which have a considerable amount of fiber in place, however, the fiber is generally low count and not deployed in locations where it provides ready access to businesses and residences.

- Phone Companies: The public switched telephone network is deployed throughout power company territory. This network consists largely of twisted-pair copper wire which has very limited bandwidth. An additional line to each DSM location would probably be required for DSM services.

- Cable TV Companies: Cable TV companies have fiber optic and coaxial cable deployed in most metro areas, yet the cable, on average, accesses only 60% of the residences. Cable systems provide mostly one way communications toward the customer. Return bandwidth, if available, is limited.

- Mobile Radio Companies: Mobile Radio companies provide wireless radio frequency (RF) communications, however, deployment is very limited.

- Satellite Networks: Satellite Networks could provide one-way communications toward the customer, but this limits its usefulness.

3.4 DSM Network Installation Considerations

The functional requirements of a two-way DSM system, as with other systems and technologies, will determine the type of technology implemented and its cost.

The following discussion covers some power company considerations for the installation of a

DSM Network as they relate to network requirement and costs.

Bandwidth: The most significant factor in selecting the type of communications system to be used for DSM services is network bandwidth, or capacity. The amount of data to be transferred and, how quickly the transfer is required, will be determining factors in the components chosen for the network. For example, an automated meter reading system requires little bandwidth, and the data is not particularity time sensitive. On the other hand, demand side management "load control" applications require large amounts of data which must be delivered in real-time.

Cost: Network Installation Cost: Network installation is by far the largest single cost for a power company to build their own DSM network. A very generalized number that gets used is that power companies would like to install a network for between $200 and $400 per residence. Roughly three-fourths of this cost is allocated to providing the electric meter interface and the communications connections back to the utility. (A *smart* meter alone can cost over $100.) The rest is for the hardware and software for data management and processing. It can be stated that cost is almost always directly proportional to bandwidth.

Reliability: A power company's uses for a DSM system, because of their application, will require that the network be highly reliable. While reliability requirements may ease somewhat as we move toward the bottom of their hierarchy of potential uses, network reliability for the primary uses will be a leading consideration in network planning. If a power company is planning to offer service to other utilities, or non-utility services to other entities, reliability requirements will be even higher.

If the utility is managing large power user loads based on being able to quickly reduce demand from these users as a peak load approaches, a failure in the communications network could have disastrous results. Because load management is a dynamic interactive process, broadband, two-way communications becomes a necessity. The central processor must be able to quickly confirm if the load reduction has taken place and if so by how much.

For a cable operator considering partnerring with a power company to install a DSM network, reliability (network availability) requirements could be more stringent than those for competitive access provider (CAP) services. For the highest capacity CAP services, the network availability requirements typically stipulate that the service be in operation 99.997% of the time. That is approximately 16 minutes per year of allowable outage, which may be too much time for primary (or high capacity) DSM services.

Ownership: With network reliability being a primary concern for power companies, we can easily surmise that power companies would prefer to not have another entity between them and their customer. In fact, it is safe to say that if cost of the network installation and operation was not a factor, power companies would not even consider outsourcing these services, particularity to large capacity users.

Security: Security of the network is another power company consideration. Is the communications link to the electric customer secure from unauthorized intrusion?

Geographic Coverage: How can ubiquitous coverage within the entire electric utility service area be provided?

Standards and Compatibility: At this point, there are no clear standards for DSM services, networks, or network interfaces. Even though some development is underway, there is no

clearly superior technology, and low cost hardware and software is not available.

❒ 4.0 Future DSM Network Planning Considerations

Because of the extensive technical and operational requirements for a DSM network, power companies logically would like to install and operate their own networks even with the high installation cost.

In addition, a power company's construction of its own network would ensure that the utility's capacity requirements would be met , and would in fact enable the utility to use excess network capacity to generate incremental revenues from utility related and non-utility services.

However, electric utilities tend to perceive non-utility services (information services, cable TV, telephone, etc.) as very speculative, high-risk businesses and probably would not use non-utility revenue potential as justification for installing their own network.

Where this all seems to be leading us is that even though power companies would prefer to install and operate their own DSM networks, they generally expect that a fully deployed DSM system will use all of the technologies discussed previously, and will consist of facilities both leased from commercial communications providers and those owned and operated by the power company. The type of technology deployed will be a function of availability, pricing, and company needs at the time.

So -- for cable TV operators planning to install full service networks, including DSM in the strategy is probably a reasonable expectation, provided that the network meets the compatibility, reliability, and security expectations and requirements of the power company.

❒ 5.0 Electric Utility Industry Demand Side Management Experience to Date

Demand side applications of two-way interactive networks are *high on the agenda of many electric power utilities.*

A number of published reports indicate that "utilities are investing in demand side management technologies". For instance, Entergy took a minority position in First Pacific Networks in 1991. The Southern Company announced that it would invest in First Pacific in 1993. Boston Edison has asked for regulatory approval to invest in an unregulated subsidiary that would invest in demand side management technologies.

There are also indications that the venture capital community is taking an interest in demand side management investment opportunities.

A large number of mature and start-up suppliers are working on demand side management technologies. These technologies are being developed to operate in a number of network environments, including broadband coaxial/fiber, twisted pair, wireless/RF, and satellite. Supplier companies include BellSouth, First Pacific Networks, RAM Mobile Data, Ericsson/GE, CableBus Corporation, AT&T, and TranstexT.

Industry-wide standards are under development, via the involvement and leadership of the Electric Power Research Institute (EPRI) and member utility companies.

Utility monitoring services are in operation in a large number of gas customer homes.

Electric power utilities have undertaken field trials of DSM technology in a limited number of homes. The objectives of these tests have been to gain experience with the technology, to gain in-market understanding of the features and functions that are most attractive to the

consumer, to determine the nature of customer use of and satisfaction, and to develop an information base that will help with packaging, pricing, and marketing decisions.

The general sense of those involved in developing the DSM business is that the power utility industry is on a "fast track" with respect to development and deployment of the technology. As we pointed out earlier in this paper, there are strong strategic and economic reasons for electric utility interest in DSM. The enabling technologies are being rather quickly developed, with functionality and price bringing product into line with utility economic requirements and customer expectations. There are still many business unknowns in terms of marketing, consumer take rate, pricing, and so forth. However, it is likely that these unknowns will be addressed in the very near term.

Finally, of all the issues that must be addressed by electric power utilities in order to make demand side management a success, perhaps the most important is the design and construction or the two-way interactive network that will link the utility with customer locations.

❒ 6.0 Collaborative Opportunities for Cable Operators and Utilities

The cable industry's advanced network deployment thrust and the electric power industry's desire to deploy demand side management services suggest that there may be substantial collaborative opportunities for the two industries, including:

- Cable company provision of the two way network to the customer.
- Cable company utilization of existing electric power utility fiber networks as part of a cable "regional networking" strategy.
- Design of in-home hardware to include functionality that meets the needs of cable companies and utilities.
- Joint marketing and promotion of services.