So You Think You're Smarter Than a 1980's DSM Resource Planner!

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ABSTRACT

This paper discusses historic and current methods, and "lessons learned" in demand-side management (DSM) or energy-efficiency (EE) resource planning over the past 25 years. We discuss the progress that has been made to some processes employed and the lack of progress in others. The two authors who actually lived the experience present an informative and humorous perspective on the topic in making comparisons to DSM/EE resource planning beginning in the 1980s and evolving to current times. The objective is to present what we have learned during our experience in DSM/EE planning and regulation that can be applied today to improve the current process and save today's planners some potential frustration.

The paper provides today's DSM/EE planners with a further appreciation of the fact that "the more things change, the more they stay the same" in the DSM resource planning world. For example, today's planners continue to struggle with the quality, comprehensiveness, definitions, and structure of the massive amount of data that is required to improve the accuracy of the DSM resource planning results. In that context, this paper describes the issues in leading a collaborative effort to develop the first comprehensive DSM resource planning database in the nation – the Northeast Regional DSM Data Exchange (NORDAX) as well as in performing the first utility integrated resource planning analysis in the nation. We do this through a step by step discussion of the genesis of the methodologies employed. The discussion also documents how those efforts compare with today's use of deemed savings and program savings databases and what was learned that can benefit today's DSM/EE planning efforts. Finally, the paper finishes with suggestions for attainment of practical planning methods based on long-ago and recent DSM resource planning experience.

The Beginning of DSM and Our Career Paths

The events of the 1970's defined our entry into DSM resource planning a decade later. Ah, the good old days! The authors of this paper are old enough to remember when demand-side management (DSM) was not called "DSM." As late as the 1980's, many utility planners still talked about "energy conservation" and "peak load reduction" programs separately rather then using the more collective terminology "demand-side management (DSM)" or "energy-efficiency" programs. And, no one back then had heard of "Market Transformation" in the context of utility programs. However, our programs were, indeed, DSM and market transformation.

At the same time, there are many similarities today to the energy situation that elevated DSM as a resource for the utilities in the 1980's. In the 1970s, we slowly reacted to the oil crisis that came to a head in 1973 with the onset of the international oil embargo. Home heating oil and oil for generating facilities was at a premium, regarding its supply and price. There were gasoline lines at the gas stations—we could only buy gas every other day based upon the last digit of your license plate and often had to endure lines lasting several hours or more. And that was only if the gas station was able to acquire gas from their supplier. Owning a large, gas-guzzling car was frowned upon. Due to the strains on the supply of oil imports, low cost oil and electricity were no longer an option for us. Life was chaotic and scary for us from an energy perspective.

The first Earth Day was held on April 22, 1970, a global ecology proclamation. This environmental movement was later linked with concerns over depletion of the earth's resources that included all energy sources. The public began to notice that their electric rates were linked with depleting resources. Coal fired plants were no longer the desirable alternative to oil generation because of the adverse environmental impacts created by the plant emissions. Nuclear generation was touted as the wave of the future through its low-cost energy supply, but the mishap at Three Mile Island in 1979 increased the costs of the already committed nuclear plants, stymied any plans for new ones and reinforced the concerns over nuclear generation safety around the nation.

Despite these events, the utilities were still slow to respond. The limited response that did occur was typically by region, with California and Wisconsin jumping on the conservation wagon by offering utility DSM programs beginning around 1975. The Northeast was slower to adopt DSM programs with our respective utilities rolling out some DSM programs about a decade later, in the mid-1980's.

One Author was Growing Up "DSM" in New York State

In New York State, the investor-owned utilities considered the initiation of DSM programs as a result of regulations surrounding the implementation of new supply options. The Order issued in 1984 required the utilities to develop conservation programs, but the regulators were not satisfied with the initial offerings by the affected utilities. Electric utilities were still looking for innovative ways to sell electric space heating to make it cheaper for customers—add-on heat pumps to fossil fuel space heating systems and electric thermal storage for those utilities that had the benefit of approved day and night electric rates, and to increase their sales through strategic load building.

The NYS PSC finally ordered that each utility submit an Annual Demand Side Management Plan in September, 1987. At the same time, a new NYS PSC Case, the long-range planning case, was proceeding, which included an order in 1988 that led to the development of the first integrated resource plans, thus defining the career path for one of the authors beyond the Supervisor of DSM Planning for New York State Electric and Gas.

One Author was Growing Up "Integrated Resource Planning" in Connecticut

Also and mainly in response to the limited supply of home heating oil in New England, the regulatory commission in Connecticut suggested that electric companies investigate opportunities for allowing their ratepayers to moderate their energy usage through company-sponsored conservation programs. Northeast Utilities (NU) filed their first strategic plans for conservation and load management programs during 1985, a small portfolio of customer conservation programs. These programs were based largely on residential and commercial building and end-use audits, some technical data developed through engineering studies of specific technologies, and the personal experience of the consumer research staff (i.e., lots of guesses) and were collectively called the "NU 80s/90s Programs." The impact of these programs was estimated to be cost-effective as determined within the very first electric Integrated Resource Planning analysis performed in the nation (NU-1984). As the Manager of the Consumer Research Section at NU, my staff and I developed all of the input data and assumptions that were required to fill the demand side of the modeling equation. There was much disagreement with the supply planners as to the validity and reasonableness of the demand data that we supplied since a lot of it was developed from bench testing of technologies and guesses as to the real impact the technologies would have in the marketplace. It was quite an adversarial process and lots of enemies were made within the company. It was not pleasant by any means. The programs that did pass the scrutiny of the model were determined not to be critical for mitigating projected problems in the system load shape, so the NU supply side "advocates" proclaimed our Northfield Mountain pumped hydro facility the answer for the future. Despite the controversy and the

struggle to have conservation taken seriously during those days, we managed to pull together our programs and began to market them to our ratepayers.

After the marketing success of our initial programs and the collection of hard program evaluation data, it was felt (through regulatory pressure) that demand-side options must be assessed against supply-side resources based upon a "level playing field." At that point, NU undertook what was referred to as an Integrated Demand and Supply Planning (IDSP) process and implemented a portfolio of enhanced DSM programs that competed favorably with the most cost-effective supply options for the service territory. The program package (that included many of the ongoing initiatives) was renamed "Energy Alliance." It was at this point that the "demand side" advocates were taken seriously, and our programs were expected to help mitigate the increasing load growth.

Both authors took the charge to do our part to reduce electricity and gas usage across the nation very seriously. This was a great time to be involved with DSM. We were thrilled to be allowed to travel to California for the first "Great PG&E Energy Expo" in 1984 and to learn from other DSM planners there. The California *Standard Practice for Cost-Benefit Analysis of Conservation and Load Management Programs* was developed in 1983 and became the industry standard methodology for evaluating utility-sponsored DSM Programs.

Back home we argued the pros and cons of the various tests for becoming the standard program cost-effectiveness test for our states. Whenever we thought we had it figured out, someone would change the terminology and the data inputs. The "no losers" test covered the "non-participants" perspective that later became the "Ratepayer Impact Measurement" or "RIM." It was confusing to us, as I am sure it is to you. But to add to the confusion, there was the "all ratepayers" perspective that became the "Total Resource Cost (TRC)" test, with an enhanced version becoming the "Societal Test." The "utility cost test" preferred by the utilities for program evaluation faded away as more emphasis was placed on a wider perspective beyond the utility with many of the states requiring environmental and other externalities to be included in some fashion within our cost benefit analysis (CBA.)

Back then there was a national initiative for energy conservation. But, despite the lack of a focused national initiative for energy efficiency today, the times really haven't changed that much, have they? Data quality is often suspect, especially when you have to use other utility estimates for DSM, terminology is confusing, deregulation has thrown a monkey-wrench into the development of model inputs, and the demand side people are still suspected of making up numbers. DSM/EE resource planning is a "hot" topic once again (i.e., everything old is new again!)

Where Did We Start?

As two utility resource planners back then "in the day," we had no real experience in developing conservation programs on which to draw. This was not because we were too young back then to draw on experience but because energy conservation programs were brand new to us as well as to the nation. We also had limited data to estimate how much energy savings and demand impact we could actually achieve from these programs. We became really creative at thinking through how a program could be designed, and in finding the data on which to estimate energy savings, market penetration, and program costs, and to "guess" how each program might impact the system load. We utilized our college calculus skills to "spread" our estimates of energy savings over estimates of the end-use unitized load shapes developed from the utility load research initiatives to produce estimates of efficient technology load shape impacts before we had metered data for the technologies. We were also able to leverage limited information available from DSM research by developing and utilizing networks of other utility DSM planners.

The authors survived the difficult formative years of DSM planning and are still translating those experiences to support resource planning activities today. We pioneered as DSM resource planners from two different combination utilities that were mandated to provide DSM with little to no expertise in-house, no

outside experts on whom to draw, and little data or effective models to support major resource planning efforts. The rest of this paper describes how we solved some of the same issues that are prevalent today in developing DSM resource plans and program designs.

The Old Models for Forecasting the System Peak Load and Energy

Faced with conservation program planning, we first sought out others within our utilities who had been there long enough to understand the electricity markets they served and to provide guidance to our forecast data inputs development. Since this allowed for performing ranges of load forecast estimates, this was a huge advancement to the very typical forecasting method of the 1970s using (literally) a straight edged ruler. It was amazing how much information we were able to glean from the veteran utility account representatives regarding how customers used our product and what made them make changes in their usage patterns. These veteran staff knew the workings of the companies and knew where the studies were located that described usage characteristics for our customer base, collected before the oil embargo of the 1970s. Many of these studies had been ad hoc projects, non-scientific and not statistically based. But they did provide a view of our customers that allowed us to make first cuts at program planning and to advance the forecasting methods beyond the ruler.

As all good planners soon realize, the first step in the DSM planning process is to develop reliable baseline data that is at a much finer level of detail than that provided from the old system peak load and energy forecasts. We could not estimate technical potential for DSM measures and programs using the then current forecasting methods. Traditionally, load forecasting models looked at growth trends by sector—residential, commercial, industrial, and other groups. DSM planners needed to know how energy was used by end-use category—space heating, cooling, ventilation, lighting, and motors as well.

Around the advent of the energy conservation movement of the late 1970s and early 1980s, the utilities began to *plan* for the *development* of solid and reliable estimates of energy usage within their customer sectors by end-use. These data development projects first began to support Federally-mandated load research for better rate research applications. This fed into the need to input statistically reliable estimates into the load and sales forecasts to improve reliability. Load forecasts moved from purely driven economic models to end-use forecasting methods. These included combination end-use and econometric models such as the Residential End-Use Energy Planning System Model (REEPS) and the Commercial End-Use Planning System (COMMEND) that were developed for the Electric Power Research Institute in the mid-1980's. These were a huge step up from straight-lining or using simple regression methods where explanatory variables were primarily national economic indicators that may or may not have tracked the economy in our service areas.

The end-use models, although in an engineering sense were reasonable and theoretically solid, had data needs beyond what most utilities could support. But since the methodology was becoming the "norm," gas and electric utilities invested large amounts of research dollars in primary data collection of appliance, end-use, and building/household characteristics. Many utilities covered their residential sectors sufficiently for their own purposes through phone and mail surveys of their customers, but few were able to support major investments in their commercial and industrial market sectors. Data for forecasting of the C & I sectors were taken from many of the audit programs that became the vogue during the late 1970s. These audit data were known to be biased, however, since the customers who requested audits were usually those who were keyed into energy conservation for their facilities. This provided little guidance to answer the main question of "how does a utility get its customers to embrace new and sometimes unusual, energy saving technologies and techniques?" But, they provided a basis for our DSM estimations. It was better then what we had preceding this research. Sounding familiar?

That Was Then and This is Now

The end-use forecasting models used then are rarely used now, and were replaced for long range planning with integrated models that use end-use data as inputs. Looking at demand impacts versus the supply plan makes sense for long-range planning now (as it did then) and planners have developed new sophisticated dynamic optimization models that rely on end-use data to model the demand perspective for the utility. And, since the oil embargo ended, oil became relatively cheap and available again, and other issues directly impacted the utility financial "bottom line" (such as deregulation and competition.) There were then other things that became more critical to utility planners than energy efficiency. DSM became three dirty words and it no longer was felt to be the answer to utility system management planning.

Getting Good Load Research Data was Expensive and Painful

Yes, we were gathering and analyzing data to support the rate setting process, but it was painful. Back in those days in order to utilize this information, we were often required to interpret the circles recorded on paper disks that were, at one time, the best method of collecting customer usage and load data. (Can you imagine making lists of numbers represented on paper disks to begin the process of DSM database development?) Fortunately for us, there was the advancement to customer data collection on magnetic tapes, also called mag-tape cartridges. We had the benefit of extraction of the data via "mini-computers" that were the size of large refrigerators and had less computing capacity then our wrist watches of today. If we wanted to link this data to the utility customer billing records, we had to go into work at 3 AM and use the mainframe computer (the size of a large room) that was used primarily for company billing. (At 3 AM, the bills were probably finished being calculated and printed, and the computer operators were bored so they were agreeable to mounting the numerous reels of magnetic tapes on the mainframe that held our planning data and analysis software.)

Still with this incredible computer analytical capability and beginnings of DSM databases, there were many companies who could not answer the principal question of "what do typical electric/gas customers look like (i.e., what are the average end-use and building characteristics for the utility customers) and how do they use their energy?"

To begin to answer these questions, regional utilities agreed to share their DSM data. Back in the good old days, there was no open competition between electric companies, and none between gas companies. So, electric utilities shared anonymous aggregate customer energy use profiles and DSM data with other electric companies. Utilities were overwhelmingly regulated monopolies. There was no concern about loss of customer base to a competitor (however, electric and gas utilities did compete for customers for some end-uses.) Electric (or gas) utilities who were fortunate enough to receive regulatory approval for enhanced end-use and building characteristics research of their customer segments, especially in the commercial sector, were willing to share their summarized data with other electric (or gas) utilities. While most utilities were willing to share the data, others said they would only "sell their data."

Metered data and load profiles for customers and end-uses were becoming more available. The problem was that we DSM resource planners were skeptical about transferability to our own utility service area. One issue was the quality of the data in terms of the statistical sampling approach and sample size. The other issue was whether the customer and end-use profiles would fit in terms of similar climates, economic conditions, energy prices, and demographics with heavy emphasis on the weather conditions under which the original data was developed. Developing end-use load profiles from borrowed load research data or from billing record energy consumption data, was a difficult but necessary task to determine DSM program impacts on peak demand with some concern for climatic influence. Weather normalization methods were developed for transferability of the data with results not verified until later. There were issues regarding what was the appropriate level of detail to use to define typical day types. The computer technology we were

using did not easily manipulate data for 8,760 hours of the year (this is pre-PCs.) A number of models were developed to help customize the load shapes to better fit our service area customers and end-uses.

That Was Then and This is Now

Load research became much more sophisticated with the variety of data loggers and meters available to those who continued the data collection. The data can now be transmitted in real time for demand response programs to ensure that the program is meeting its goals. At the same time load research, including metering of end-use equipment, is used very selectively. The cost of visiting the site, installing meters, revisiting the site to remove meters, and analyzing the data is still expensive. This is why many utilities decided to abandon their emphasis on this research. For those who still perform such research, the good news is that rate research methods have evolved and we are able to learn more and more from the studies. Data mining of older load research databases and more efficient load research sampling plans can be employed to get more for less and for those who no longer collect such data. The task of developing load shape impacts is even more complex today. Many utilities no longer own their own generating units and the market price of electricity at various times of the day can change quickly. More good news is that today's personal computers can handle 8,760 hourly load shapes, if data are available. The bad news is that customers are changing their energy use profiles with the new technologies evolving and accepted in the marketplace. Thus, our old data may no longer reflect reality.

We Scrounged for Measure and Program Data

Okay, so now we had some more sophisticated load forecasting models that would break out energy use by end-use category for key customer sectors. And we actually had some good load studies and market research to support those models, so we felt somewhat comfortable with our modeling results. Our next chore was to figure out how much these "yet to be designed" DSM programs could actually save and when during the system load shape would the savings occur - a very big "if." The regulators, not to mention the system planners and upper utility management, were waiting to closely scrutinize those "soft negawatts" that we could achieve from DSM programs. This was a big problem for us in that there were few mature DSM programs that had collected good quality data for program participation and impacts. In addition, the program data that was available were often planning estimates and not based on true measurement. Those "supply-siders" also felt that DSM programs were unreliable and they would not be able to depend on their impacts on the utility system (DSM got little credit and the supply planners became the DSM planners enemy). For those of us who wore two hats—DSM planning and DSM evaluation—the marketing staff did not like us either. They were responsible for enticing the customers to participate and to save the targeted energy, and their performance ratings depended on our assessment of how much they had actually saved from the DSM programs.

Finally, when programs did get implemented and eventually evaluated for energy savings, there was no consistent format for reporting the results. A participant in one utility's program could be a "water heater" while another utility with a similar program would consider the participant to be a "building." The energy savings were based on gross engineering estimates for one program and net impacts that accounted for free ridership for another program.

One of the marquee projects developed early in the DSM resource planning era was known as "NORDAX" (the Northeast Region DSM Data Exchange). This project, which began in 1987, was conceived by one of the authors of this paper and was funded by the U.S. Department of Energy through its LCUP (Least Cost Utility Planning) initiative. It was the first time that customer market sector descriptive data and conservation data (which had officially moved into the definition of "DSM") were brought together in a joint utility database for all contributing utilities to use for their future DSM program and resource

planning. It provided more specific customer data and actual DSM program results (participant units, costs, energy and demand savings) for forecasting energy use which could feed into program design and long-term strategic DSM resource planning. The NORDAX project was funded at $75,000 by the DOE LCUP program and the 20 member utilities from the Northeast that included:

- Baltimore Gas and Electric
- Boston Edison Company
- Central Hudson Gas & Electric Company
- Central Maine Power
- Central Vermont Public Service Corporation
- Commonwealth Electric Company
- Consolidated Edison Company of New York, Inc.
- Eastern Utilities Associates
- Jersey Central Power & Light Company
- Long Island Lighting Company
- New England Power Service Company
- New York State Electric & Gas Corporation
- Niagara Mohawk Power Corporation
- Northeast Utilities
- Ontario Hydro
- Orange & Rockland Utilities
- Philadelphia Electric Company
- Potomac Electric Power Company
- Public Service Electric & Gas Company
- Rochester Gas & Electric Company

In addition to providing a membership fee, each of the utilities agreed to supply data to the NORDAX database that was organized into four modules: (1) Utility Data Module; (2) Technology Data Module; (3) Program Data Module; and (4) DSM Personnel Contact Information Module. NORDAX was organized with oversight by the Board of Directors. There were also an Executive Management Committee (EMC) and a Technical Working Group (TWG) that supervised the work of a consulting firm who were responsible for collecting and organizing the data for the database. Although the database was invaluable to the development of our DSM resource plans, the networking opportunities were unprecedented. A member of NORDAX could pick up the phone and call his or her counterpart at 19 other utilities and get information to help resolve a DSM planning, evaluation, implementation, or management issue. NORDAX was one of our major success stories. But, …

NORDAX "went away" after key individuals left the sponsoring utilities and moved on to consulting and other career paths and no one else picked up the ball. Even more critical to disbanding NORDAX, was the advent of deregulation. Utilities went back to not sharing of program data or any other information with others who may be competing for the same customers. At the same time, the legacy of NORDAX lived on as models for other major databases that including initial design of the Database for Energy-Efficient Resources (DEER) in California.

Another project that flowed from the NORDAX work was initiated by Eric Hirst at Oak Ridge National Lab (ORNL) in conjunction with one of the authors. That project was to develop national DSM program reporting standards and terminology. The results were published by ORNL and the Electric Power Research Institute (EPRI) in 1992 and used as the "bible" for definitions of DSM terms such as spillover, free riders, technical potential, market potential, and economic potential.

That Was Then and This is Now

Today, as in the old days, as we plan new DSM initiatives, no one utility can afford to create utility-specific data to support our planning models. We look to other databases for support to our own data development. Thank goodness there are good initiatives across the nation that support public information on DSM and that we can utilize. The California DEER database is one from which we can draw. Although it is developed from California-specific programs and research, it provides us with a place from which to start to estimate our own program impacts. However, as with all borrowed data, care must be taken to "adjust" the data for weather impacts to reflect the change between California and your service territory region. The almost universal acceptance of the California Standard Practice Tests for estimation of the cost-benefits of DSM programs has helped to make the data developed from DSM more consistent and, therefore, more comparable between regions and utilities. Other regional, state and utility market assessment projects such as the Wisconsin Focus on Energy have produced DSM program data that can be drawn upon when we seek data to support DSM resource planning project. We can also purchase data from many sources such as from industry-specific associations or manufacturers' sales and technical data. The U.S. Department of Energy (DOE) provides energy savings data and models related to their Energy Star initiative across the nation that we can tap via their website. There are also advances in the estimation of the effects of various end-use technologies, and upgrades and changes to building designs and construction techniques through engineering and building simulation modeling that can produce remarkably reliable results for our DSM planning. One must be mindful, though, that all borrowed data is used *considering* and *accounting for* the potential impacting issues under which for the data was initially developed.

It Was A Challenge to Find and Understand the IRP Models

With better DSM data, we thought that the rest would be easy. But our euphoria soon ended when we had to actually develop our DSM resource plans. The supply-side planners had ProMod and other system planning models that simulated individual utility generation or multi-area generation for power pools. EPRI developed new models such as DSManager to screen DSM measures. There were other commercially available models such as COMPASS and BenCost to perform similar analyses. The challenge for us was to understand how some of these models actually worked internally, especially for commercial models where the code was usually proprietary. Some were total "black boxes" and the only way to understand how they worked was to vary the input data and re-run the models over and over to see if the results were reasonable and consistent. DSStrategist was used and was developed within a spreadsheet model. Thus, the data and calculations were transparent for the user. This became a nice feature as the utility planner could "adjust" aspects of the analyses as needed without having to call in the consulting experts.

In addition, the supply side models and demand-side models were not totally integrated. The supply side planners didn't want to give up their traditional practices to use an integrated IRP model that placed a lot of emphasis on the DSM resource data. EPRI's Electric Generation Expansion Analysis System (EGEAS) did allow comparisons between DSM and supply side options but was not a truly integrated model. After all, the supply planners knew their data was hard, accurate, and easily developed. They got bids for construction of new generating facilities and used those numbers to model the future of utility supply. DSM planners really could not do that as easily. The supply planners were very certain that their supply options would be there when needed. They felt that the same was not so for DSM.

That Was Then and This is Now

Today, new versions of integrated resource planning models are available for sale. They are different from the pre-deregulation period in that the market price of power must be modeled rather then modeling the utility generator cost. Such models as DSMore and many others commonly used today are statistically modeled and coded using "optimization" methodologies where the "best" resource, be it supply or demand-based, is "chosen" for implementation at the best time it is needed within the planning horizon. Of course, the definition of "best" resource can vary depending on the needs and situations found for each utility and is almost totally dependent on the quality of the data input to the model. More sophisticated and maybe more realistic modeling capabilities are found now, but the data needs and quality remain the same. We continue to have great research coming from the national laboratories, and from universities that contribute to our understanding of the data. We also are more strict with the manufacturers of new technologies and require solid proof of the workings and impact of their products. However, today's supply planners often still view our DSM data as "fluid" and do not trust our assumptions as much as their own. We must strive to secure the trust of these major players in our resource planning activities.

Prediction of Customer Response to DSM Programs

In our past lives as utility DSM planners, not only did we have to quickly come up to speed in our engineering understanding of energy efficiency technologies and construction practices, but we had to become psychic in order to guess how our customers might accept our DSM program offerings. There was little information from which we could draw regarding how successfully we could influence the market through the offering of various initiatives for the purchase and use of DSM. We did know, generally, how customers responded to new appliances introduced in the marketplace since many utilities offered new appliance purchase opportunities through the utility marketing (and sometimes home economist) departments and divisions. There was a new research focus on purchase patterns by the consumer package goods industry that we followed. Rebates were being offered for other purchases that we also followed. Remember the home PC from Texas Instruments? That was one of the first major rebate initiatives in the nation and was found to be very successful means to push the market. We began to believe that we could utilize the rebate/incentive model as well and many of our first DSM program plans included lots of rebate programs.

Also, EPRI tried to help us with their Customer Preference and Behavior Study in the late 1980's, a project on which one of this paper's authors served as a utility advisor and researcher. They produced the PULSE and CLASSIFY models. One would categorize customers based on their lifestyle, personality, attitudes and values into such segments as "pleasure seekers" and "hassle avoiders" using a simple questionnaire and a reasonably complex statistical analysis. The other model would help translate these customer response segments to different DSM program options. This was an interesting project that one author used to help identify response to electric thermal storage heating for residential customers. We conducted surveys to "classify" the customers and used "conjoint analysis" to determine how many customers would likely buy the product based on different program features. As a result, we knew what "segments" were likely to be early adopters and late adopters, but could not easily find them among our 300,000 residential customers. We did find out that with a big rebate, we could push the marketplace and sell these new units. We also found out that we could design advertising that would appeal most to the segments with the highest potential to install ETS systems. This process was replicated many times by the other co-author to help estimate market potential for DSM programs that were input to the company's annual and then semi-annual IRP analyses. This EPRI project was one of the most groundbreaking activities in their DSM research offerings.

We still had to fight the battle of estimating what impact we could plan for from the package of programs modeled for the next year and the following 5 years and more. Estimating the impacts from energy efficiency education initiatives was particularly problematic, as were the impacts due to customer on-site audits. This became significant since so much of the DSM relied on major educational outreach. We also assumed that customer purchase tended to follow a traditional "S" shaped curve where the response began very low when the technology was first introduced, and rose to some maximum level as the technology matured and flowed into the marketplace. We did not know what that maximum level was for any specific technology, but we knew it probably would never be 100% of the market. We also did not know how quickly that curve rose over time. We did know that the rate at which the curve rose could be influenced through various marketing strategies such as through rebates and incentives. We were able to take reasonable guesses on this rate of rise based on watching other technology sales in other industries and from evaluating our DSM programs. Although NORDAX helped, there was not sufficient program maturity in the industry to really provide us with explicit answers. We needed sufficient program history to determine how the penetration levels of DSM measures, efficient equipment and practices changed as the program matured and the technology became more widely accepted and available.

And, from the EPRI research we have learned that there are multitudes of factors that influence how a customer will react to a new energy-using technology, be it in reason to purchase, usage behavior, and influence towards other energy efficiency. This is a never ending research need and continued assessment of these influential factors are required.

That Was Then and This is Now

Our understanding of the energy efficient technologies that we promote is improved due to the flow of quality engineers and economists into our business. Colleges and universities around the world are offering courses and disciplines of study relating to energy efficiency and resource planning. Also, we now have close to 30 years of program experience on which to draw. Other industries have studied consumer purchase behavior and offer models for prediction of market penetration that we can utilize for our purposes. However, the question regarding what is the true impact of energy efficiency education programs is still unanswered and remains a major issue with utilities and regulatory commissions to whom they report.

Most utilities are still reluctant to allocate sufficient budgets to conduct sophisticated market research, conduct metering at participant sites, and develop sophisticated tracking systems. In addition, there is a mentality that vendors and contractors need not be burdened with data collection despite their financial benefits from utility rebate programs.

New targets are being set for energy reduction and it is imperative to the utilities and other program administrators to be able to measure the direct impacts of their programs. It is clear that information and education programs play a role in customer's adopting energy efficiency but there is a need for better tracking of actions taken by participants to estimate these additional energy savings and to assess the various influences that played a role in the decision to participate.

So, What We Have Learned Over the Past 25 Years of DSM Resource Planning?

We have found that obtaining good, quality "data" is still an issue for us. For states such as Wisconsin, New York, Maine, Vermont, and California where programs are administered by third-parties or state entities, getting customer billing data for baseline and EE/DSM program impact analysis is more of a challenge then for others. Deregulation has not made it any easier today to develop EE/DSM resource plans.

The reach of EE/DSM programs, even when offered by utilities, has expanded outside of service area boundaries. Many of the programs will target the market actors high up in the supply chain. Those market actors include equipment manufacturers and corporate decision-makers for national chains and multi-location businesses. The good news is that from this high level actor targeting, the utility can have a much

greater impact with their program then they would have without this targeting. The bad news, however, is that the utility typically does not get credit for energy savings outside of their service area, even if they were able to measure those impacts.

Market transformation has occurred for some energy-efficient technologies and practices, which can make it more difficult to establish a baseline against which to estimate the impacts of a EE/DSM program going forward in time. The *definition* of market transformation may be a confused issue that should be addressed for the utility and assessed for impact in baselines.

The job of EE/DSM resource planning has not gotten any easier, but you can draw from our experience in identifying some area where we have gained experience or have tips to make the process more effective. Some of these suggestions for include:

- **The Best Practice for one utility may not be the Best Practice for another**—Best Practices are dependent upon the level of maturity associated with the utility planning process. Evolved utility planning processes and philosophies may be better able to implement and benefit from more sophisticated, complicated, and data-intensive program plans then those lacking experience. And, sometimes it is best to "just do it" and promote EE measures to get the EE message out to the potential participants. The EE knowledge can then stimulate additional EE.
- **Involve the evaluation team early on in the EE/DSM program planning phase**—an experienced consultant can help improve program design based on experience in evaluating similar programs. In addition, the evaluation team will help ensure that key data are being tracked to measure program impacts and to improve program design in the future.
- **Be open-minded about the models being proposed by the EE/DSM resource planner**—they are only as good as the data available to support the models.
- **Find opportunities to share load research or other EE/DSM program data**—the cost of a load research project can be shared with utilities that have similar customers, similar operating conditions, and similar goals and objectives for the research.
- **Involve the people "who know" in the process**—the account managers for utility-specific plans and the utilities' managers for statewide DSM resource plans can contribute significant insight to how best to market to the customer segments of interest.
- **Make sure you know the basis for the borrowed data you use**—and adjust it accordingly so that matches your service territory situation (i.e., weather adjustments and others as identified.) Understand the difference between pre-program estimates and evaluation data.
- **Do not be afraid to use older research and data to guide your estimates for EE/DSM option planning**—there is a wealth of information at your company that can be mined for information about your customers and to help assess potential market activity.
- **Be creative in using your data**—most EE/DSM options are analyzed based on a view of a typical or average installation. Making estimates of high and low bounds on the option plans and/or varying the definition of a typical installation can provide ranges of impact. These ranges can be used in your planning model to establish "scenarios," one method to assess uncertainty in your plan.
- **Use varying modeling approaches when possible**—no two planning models produce the same results. Using multiple models, although sometimes difficult due to time and data constraints, will help you understand the underlying assumptions within the models and will allow you to produce results that may be more applicable to your situation. It also is a way to assess uncertainty in results.
- **If you develop a comprehensive DSM database** to serve your purposes, make sure there are others around you who are as wedded to the upkeep and updating of that data. As staff move along, the knowledge required to properly use that data (or even to know that it exists,) often leaves too.

- **Seek the wisdom and experience of "old timers" in the industry**—they have been around the block, have a better understanding of the workings of the industry, know where there might be data and information within your company that is not commonly known, and they are great at reviewing model inputs and results for reasonability. They also can help you understand your baseline estimates and keep your research grounded to reality as you become embroiled in planning analyses and details.
- **Involve the players who are stakeholders in your program into your planning activities**—it is best to get all the issues stated and assessed before a program is launched. A way to increase the probability of program success is to make the players take responsible for the plan in some manner. Their involvement promotes "buy-in" to the plan.
- **When all else fails, make some phone calls to utility planners who have done it before**—simple phone calls can provide leads to people and ideas that just might answer your questions or provide you with supporting data.
- **Buy a good pair of reading glasses**—because the DSM data print becomes very small after looking at it for 30 years.