"Herding Cats: Challenges in Corralling DSM Technologies Data Needed for Assessing Your DSM Potential and Planning Programs"

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Abstract

There is a renaissance of demand side management (DSM) program planning activity taking place in the US. Many utilities, state and regional entities are developing or updating DSM technology databases for assessing energy efficiency potential, planning programs, and determining impacts. Recent developments in the establishment of market for trading energy efficiency credits and counting energy efficiency in meeting portfolio requirements are putting increased pressure on the need for good data and defensible assumptions.

This paper presents some tips for those first meeting these challenges based on experience with three DSM potential studies. The paper shares common challenges in developing the data necessary to estimate DSM potential in a utility service territory or region, and key steps for making good choices.

Introduction

Energy efficiency programs have been around for a long time, dating back to the early years of the National Energy Conservation Policy Act under the Carter Administration in the late 1970's. And programs have been evaluated to estimate their program impacts since that time, including studies that estimate and even measure the energy savings that result from replacing one technology with another. So it would be logical to assume that by now, 30 years later, anyone designing a new program could find parameters to develop energy savings estimates for commonly applied technologies like CFLs and weather stripping, and even for overall programs. There is so much experience, and so many evaluations have been conducted over the past 20 years, that most people would assume good estimates of adoption rates, program budgets, etc. are readily available.

The assumption that such estimates exist is behind the development of program planning and evaluation technology databases such as those used in California, Vermont, Texas, and the Pacific Northwest. Such databases are meant to be used by planners and evaluators so that we can benefit from the history of studies and not reinvent the wheel. They represent the culmination of years of research studies, and are updated frequently to reflect new information as it becomes available.

And while the databases do capture much of the existing knowledge – particularly related to energy savings – and make it available for energy efficiency researchers, they cannot possibly capture all the conditions and applications of a technology. There will always be gaps. So planners and evaluators look to other studies and sources to fill the gaps, and may even design and carry out additional primary research to improve upon the estimates from these secondary sources.

Regardless of the level of rigor with which one reviews and considers the available data on a given technology applied in a specific market under specified conditions (climate zone, etc.), the resulting number remains just an estimate and questions will remain as to how accurate the estimates are. All too often, once you think you have an estimate down, another source pops up to skewer your assumptions.

This paper walks through a series of steps that are fairly common in reviewing and selecting data for DSM assessment purposes, drawing on our experience with three market potential studies.

Determining Key Inputs for a DSM Model

DSM potential studies are heavily dependent on secondary data reviews. These studies often assess the potential of a wide variety of measures and opportunities for all sectors (e.g., residential, small commercial, medium to large commercial, industrial). Because collecting primary data is so expensive, most program planners use secondary resources.

Every time a market potential study commences we move forward with some optimism – *this* time we'll find the perfect data source, the perfect report, the perfect database with all the perfect information. The climate will be similar to the clients' climate, the incremental costs will reflect current prices, and the savings will be supported by thorough and defensible estimating techniques.

But experience so far shows that once we start looking at the secondary research, we realize our optimism has been unfounded. A review of conference papers and publicly available program information and evaluation reports quickly reveals that not only was the data inconsistent, but the techniques used to provide the estimates varied considerably. And the times when consistent data could be found, it turned out it simply referenced another already identified. The questions then becomes: where are the *best* sources, how do we find those sources, and, with the variety of information available, which is the best source to use?

This section discusses the process used to identify the sources and inputs for DSM modeling. This discussion includes example data from a residential CFL program, followed by a commercial CFL program. The process described is fairly common among projects that do not have the benefit of primary data collection. As the reader will note, while this was not a scientific process, the research team attempted to be as systematic as possible in estimating key values.

Step 1: What utility and measure data do we really have?

This should be the most straightforward of all the tasks, to assess the data available to the contractor, and its usability. Ideally, the data would be utility and geographically specific. The types of data needed for the modeling include appliance saturation, load shape, and market data.

While it's usually not difficult to obtain load shape and weather station data from the utility, it *is* necessary to fully understand how the utility records load shape data, including how customer classes are defined. What is more difficult is to obtain saturation and market data. As we often experience, utilities do not devote resources to assessing

applicant saturation data or to collecting relevant market data anymore. If data is available, it tends to be at least several years outdated. With efficiency levels regularly changing and other market drivers impacting purchasing behaviors, even a few years' difference could significantly change the energy efficiency and load management equipment landscape.

One of our projects addressed this very issue. The client did not have any current saturation data for either commercial or residential customers. The utility did not consider it worthwhile to fund another study, so we needed to make assumptions about the incidence of specific appliances or efficiency levels already on the market. In the absence of market data, we did the following:

- **Assessed the energy efficiency market maturity through a thorough market assessment.** A review of other programs offered by that utility or neighboring utilities, and reach of those programs into the customer markets, will help the evaluator identify the maturity of the market. Is the utility on the cutting edge? Have they raised the efficiency standards for which certain equipment can be deemed program-eligible above and beyond current energy-efficiency tiers? Or have the utility and any surrounding utilities been relatively quiet in terms of energy efficiency and demand side management programs. Also important is whether there are any other sources of DSM programs beyond the utility that may be shaping the market, such as public benefits programs that fund statewide DSM programs.

  The market assessment can be performed by interviewing utility staff and, if budget allows, market actors. Other utility-specific documentation, including the utility website, should also be reviewed at the onset of the program. It's also helpful to review information on states participating in public benefits programs to determine whether they are a sufficient enough market force to have affected local or national change. The American Council for an Energy Efficient Economy (ACEEE) is one resource that provides literature related to public benefits offerings by state[1].

  Finally, the US Department of Energy (DOE) Energy Information Administration (EIA) publishes information by utility on sales, revenue, and spending directed to DSM in the marketplace. Although not a completely accurate assessment tool, the information provides a benchmark against other utilities when DSM spend is reviewed against a utility's revenue stream.

  The abovementioned utility's market was extremely immature. Not only had the utility not dedicated many resources to DSM in previous years, but the programs to which the utility did provide resources were not always implemented effectively and tended to have few participants. There were no public funds streaming into DSM opportunities for utility customers, and no other utility had enough of a presence to significantly affect DSM awareness and purchasing. These factors simplified the market assessment process and

[1] http://www.aceee.org/briefs/mktabl.htm

the need for saturation data. But obviously the more geography-specific, primary market data you have, the better.

- **Gather saturation data from studies in similar markets.** There are a substantial number of saturation studies available on evaluation databases, particularly related to the residential market. These data are helpful in estimating the prevalence of specific measures in the market and feeds into the screening process for which measures to include in the study. If a high percentage of customers have adopted a certain technology, then the impacts of a program aimed at that technology may be reduced.

  When using other saturation reports, it is important to note the maturity of the market where the study was conducted and the time that has elapsed since the study. The study could have been completed in a market deemed progressive in terms of energy conservation. However, especially with the progressive markets, it is important to note if the study was completed at a time when other programs or efforts were driving purchasing or retrofitting behaviors.

The influence from both market actors and the supply chain also need to be taken into consideration when estimating a DSM program's potential. This information is particularly useful for commercial and industrial customers, where estimates of equipment within these sectors are difficult to obtain. This information is rarely available without primary data collection. In the absence of primary data, we reviewed industry trends denoted on websites such as the Association of Home Appliance Manufacturers and other programs' evaluation reports. This area is more difficult to assess than saturation data, and sometimes may be simply noted as a risk in a market potential study rather than actually quantified for the modeling.

Step 2: Gathering the key measure inputs

The market assessment provides evaluators a means to assess the extent to which measures infiltrate the current market, which later provides the context for estimating participation levels. The next step is to identify the range of measures to be included in the DSM potential study, and then to gather measure-specific data that will directly feed into the data inputs. Specific measure requirements include, but are not limited to: energy savings (kWh, therms), demand savings (kW), effective useful life, and incremental costs. It also is useful to capture free-ridership and free-drivership rates for programs that include the measures being reviewed.

Once again, if there is no primary data available, the option is to review secondary data. The resurgence of DSM programs means new studies are beginning to trickle into the market, such as the recent market potential studies published by ACEEE for the states of Florida and Texas[2]. Some studies, typically those conducted for states or government agencies, are publicly available.

There are also databases that serve as clearinghouses for evaluation reports measure-related data. One database, already referred to above, is the well-known Database for Energy Efficient Resources (DEER) sponsored by the California Energy Commission

[2] www.aceee.org

and California Public Utilities Commission[3]. The database provides estimates, by measure, of energy and peak demand savings, effective useful life, and measure costs. The database was most recently updated in 2005, and is undergoing another revision now. As noted on the DEER website, there are over 130,000 unique records representing over 360 unique measures. Even the most data-savvy individual can get bogged down by that amount of data!

Anther potentially useful database is the Market Assessment and Program Evaluation (MAPE) Clearinghouse, which stores program evaluation reports and market potential studies, among other documents[4]. The clearinghouse, which is maintained by the Consortium for Energy Efficiency (CEE), stores over 400 documents and is an invaluable tool for identifying evaluation reports.

Because the state produces so many reports, the MAPE Clearinghouse does not include the vast majority of California-related reports, and refers the user to the California Measurement Advisory Council (CALMAC) website. More than 700 measurement and evaluation reports can be accessed in this searchable database[5].

With all these different resources, one can imagine that the variations in data are mind boggling! For example, in reviewing the savings data, there are key pieces of information to consider, including:

- What is the baseline?
- Is the savings based on a replacement or new installation?
- What is the climate in which the study was assessed, and is the measure affected by any climate differences?
- Are the savings based on other secondary literature reviews or primary data collection?
- If secondary data reviews, what are the sources?
- If primary data collection, does the study include enough valid cases to deem the study reliable?

Similar questions arise when gathering information related to free-ridership and free-drivership rates. These rates denote what percent of the population would install the measure in the absence of the program or what measures were installed as a result of the program. The rates are particularly important for determining program cost-effectiveness. As with the savings data, there are many variations in how these estimates are derived.

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[3] http://www.energy.ca.gov/deer/index.html

[4] http://www.cee1.org/eval/clearinghouse.php3

[5] http://www.calmac.org/

Step 3: Sorting and sifting by comparing the data

To overcome this litany of potential issues, PA developed a tool to capture measure inputs from all resources reviewed. The tool details measure-specific information such as energy and demand savings, effective useful life, incremental costs, and free-ridership rates. The tool also provides a means for capturing the climate within which the savings were estimated and documents any methodological information. And most importantly, it documents the source from which information was gathered.

The benefit of capturing the data this way is that, in reviewing specific measures, all data sources and values can be compared. For example, as the table below shows, there are variations related to savings values for the CFLs in a residential CFL program. However, the table also shows these distinctions were based on a wide variety of factors such as the baseline equipment and the bulb wattage with which the baseline bulb is replaced.

Blank cells indicate the information was not provided within that source. Not all documents provide the same level of detail. While the majority of sources report savings data in some fashion, other data points, such as incremental cost and effective useful life, are less commonly reported. The DEER database was useful in filling in the blank holes, or verifying data collected.

Table 1: Residential Lighting Savings Comparison[6]

Measure Description	kWh Savings (annual)	kW Savings (annual)	Effective Useful Life	Incremental Cost
CFL	76	0.002		
CFL	35.8	2.5	6 years	
CFL replace 40 with 15 watt	36.5	0.006		
CFL replace 60 with 20 watt	58.3	0.009		
CFL replace 75 with 23	75.8	0.012		
CFL replace 100 with 27	106.5	0.016		
CFL	55			$5

The complications of estimating savings for commercial and industrial customers are complicated exponentially. Estimates can be significantly different based on the variability of potential measures, size and use of the building or facility, and total number of potential retrofits.

Again, take lighting measures, which are often the most straight-forward measure to estimate. Commercial lighting estimates reported vary considerably, especially when compared with residential lighting. Lighting savings often are estimated on a project basis, which depends highly on facility type, size, and hours of operation.

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[6] "Residential Default Savings for Focus on Energy" prepared by Wisconsin Energy Conservation Corporation (WECC): Madison, WI (April 2002).

Internal working file for Focus on Energy Program Benefit Cost Analysis, Deemed Savings Values by Measure (AppdxC – MeasureSavingsValues.xls): Madison, WI.

"Wisconsin's Statewide Technical & Economic Potential." Report Number 119-1, Energy Center of Wisconsin: Madison, WI (1994).

Frontier TX 2002: "Deemed Savings, Installation & Efficiency Standards for Residential and Small Commercial Standard Offer Program, Hard-to-Reach Standard Offer Program, ENERGY STAR New Home Program, AC Distributor Program." Frontier Associates LLC: Austin, TX (February 2002); Confidential Market Assessment Draft Report for two southern utilities. (May 2007).

Table 2: Commercial Lighting Options and Savings Comparison[7]

Measure Description	kWh Savings (annual)	kW Savings (annual)	Effective Useful Life	Incremental Cost
New and Retrofit Efficient Lighting	14,000		18	$3,682 to $4,603
Fluorescent Lighting Improvements	122, or 3.21 per sq ft		13	$4 per fixture
HID lighting improvements	447, or 1.57 per sq ft		13.5	$60 per fixture
Super T8 Fixtures from 34W T12	173	0	15	$65
Super T8 Fixtures from Standard T8	77	0	15	$25
T5 fluorescent high-bay fixtures	418	0.1	15	$100
T5 troffer/wrap	92	0	15	$40
T5 industrial strip	84	0	15	$40
T5 indirect	92	0	15	$40
CFL fixture	100487	0.1	15	$35
CFL screw-in	2800	0.10000	3.4	$1
Exterior HID	100140	0	15	$30
Electric HID fixture upgrade	385	0.1	15	$100
Halogen infrared bulb	52	0	1.3	$6
Integrated ballast MH 25W	223	0.1	3.4	$40
Indirect fluorescent 23W	230	0.1	4.9	$22

Step 4: Selecting and apply the best estimates

Once you understand the range of estimates for each technology being considered, you have to make choices about which ones to use. These choices should be driven by consideration of the conditions that are most like the client for whom the study is being applied – particularly in terms of climate zone and as many other variables as can be determined from the literature review. Decisions need to be documented and sources noted.

In several previous studies, PA applied an expert panel approach to feed into the final selection of estimates. This approach involves providing data choices and information to a panel of experienced individuals (can consist of research team members, client

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[7] Elliott, R. Neal, M. Eldridge, A. Shipley, J. Laitner, S. Nadel, A. Silverstein, B. Hedman, and M. Sloan, "Potential for Energy Efficiency, Demand Response, and Onsite Renewable Energy to Meet Texas's Growing Electricity Needs." Report Number E073, American Council for an Energy-Efficient Economy: Washington, DC (March 2007).

"Achievable Electricity Savings Potential for the State of North Carolina." Prepared and submitted by GDS Associates, Inc.: Marietta, GA (October 20, 2006).

Confidential Market Assessment Draft Report for two southern utilities. (May 2007).

representatives and even outside stakeholders, depending on the interests of the client). Panel members then make selections and recommendations with notes defending their choices. Discussion ensues on those technology parameters that still show the widest variation based on the votes of the expert panel until consensus is reached as to the best numbers to use.

Another approach that can be useful is to review a DSM portfolio offered by other utility or state-run programs. Oftentimes this type of review feeds the non-savings inputs, such as participation rates.

Conclusions

The creation of technology databases and deemed energy savings estimates is a reasonable and highly useful development in the industry. These tools should continue to be improved and updated as they provide an invaluable resource for planners and evaluators. But you need to keep in mind that the values are just estimates, and take care as you apply them for specific clients. Nothing replaces primary data and short of that, common sense.