DAWG Days of the Summer Study: Demand Analysis Working Group

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ABSTRACT

The Demand Analysis Working Group (DAWG), is a first-of-its-kind stakeholder group initiated by the California Energy Commission (Energy Commission) to provide a forum for sharing information pertinent to electricity and natural gas demand forecasting in California. Energy Commission, California Public Utilities Commission (CPUC) and California Independent System Operator (CAISO) staff serve as the DAWG's Executive Steering Committee. Investor-Owned Utilities (IOUs) and Publicly-Owned Utilities (POUs) participate, together with a number of other organizations including ratepayer, industry and environmental advocates, educational and research institutions, and other interested professionals.

The DAWG was originally established to improve methods and processes for incorporating energy efficiency impacts into demand forecasts, which in turn, serve as the basis for resource planning and procurement. While DAWG now encompasses several other topic areas, ensuring that energy efficiency savings flow through to resource planning and procurement remains a core goal.

The DAWG is beneficial from both an inter- and intra-organizational perspective. In California, responsibilities for energy efficiency, demand forecasting and resource procurement are disbursed among several different agencies and organizations. In most cases, functional groups that manage these processes operate in separate arenas within the organizations. DAWG provides a meaningful opportunity for personnel in all of these roles to interact and coordinate.

This paper will describe the rationale for creating the DAWG, lessons learned, and current issues. The DAWG may serve as a model for other states or jurisdictions seeking to ensure that efficiency is properly reflected in resource planning and procurement.

Introduction

The Demand Analysis Working Group (DAWG), is a first-of-its-kind stakeholder group initiated by the California Energy Commission (Energy Commission) to provide a forum for sharing information pertinent to electricity and natural gas demand forecasting in California. Energy Commission, California Public Utilities Commission (CPUC) and California Independent System Operator (CAISO) staff serve as the DAWG's Executive Steering Committee. Investor-Owned Utilities (IOUs) and Publicly-Owned Utilities (POUs) participate, together with a number of other organizations including ratepayer, industry and environmental advocates, educational and research institutions, and other interested professionals.

Demand forecasts vetted through regulatory proceedings serve as the basis for resource procurement in California. Consequently, initiatives, policies or activities intended to reduce or

[1] This paper represents the independent work of the author, not the official positions of any other organization, regulatory or governmental agency. Nick Fugate, Ian Hoffman and Janine Migden provided excellent and helpful comments on an earlier draft.

modify energy consumption “that would otherwise have occurred” must be reflected in those forecasts in order to influence procurement decisions.

These “demand modifiers” include impacts from:

- Energy efficiency (codes, standards and programs) -- to reduce consumption
- Demand response programs --to alter the timing of consumption
- Customer-side distributed generation (to reduce the consumption of power provided via central-station plants and pipelines).

Programmatic, economic and/or policy instruments like rate structures and tariffs that affect the nature or timing of consumption are also demand modifiers.

In California, institutional responsibilities for demand modifying activities, demand forecasting and resource procurement are disbursed among several different agencies and organizations. In most cases, functional groups that manage these processes operate in separate arenas within the organizations. The original motivation for forming the DAWG was to improve methods and processes for incorporating energy efficiency impacts into demand forecasts, so that those impacts could be properly considered in procurement decisions. Over time, the DAWG has expanded to encompass groups that focus specifically on forecasting methodologies and on demand-modifying resources other than energy efficiency. However, ensuring that energy efficiency savings flow through to resource planning and procurement remains a core purpose, and will be the primary focus of this paper.

The first and second portions of the paper describe the DAWG’s origin and structure. The next section highlights issues and lessons. The final section covers current DAWG topics and plans for the future.

Background

When it began in 2008, the DAWG focused entirely on improving the quantification of energy efficiency in demand forecasts. Indeed, the DAWG was initially called the “Demand Forecasting Energy Efficiency Quantification Project (DFEEQP)” but that name was changed in 2010 to better reflect the working group’s scope and activities. (And because the acronym was unpronounceable.)[2]

In California, the Energy Commission is responsible for forecasting the state’s future energy needs. It produces an adopted forecast as one component of its biennial Integrated Energy Policy Report (IEPR).[3] The IEPR forecast serves as the “reference forecast” used in several of the state’s major resource planning processes.[4] These include the CPUC’s Long Term

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[2] The term “DAWG” is used throughout this paper.

[3] In practice, “the” IEPR forecast is an analytical product offering a number of forecast-related analyses including statewide forecasts for long-term electricity demand, peak demand, and for natural gas. It includes several different demand scenarios and breakouts for key service territories/transmission zones. These scenarios and breakouts can be used differently in different regulatory processes as needed and appropriate. Similarly, “the” Energy Commission’s forecasting model is actually a number of models and approaches used in combination to produce the IEPR forecasts. http://www.energy.ca.gov/energypolicy/

[4] Some adjustments to the IEPR forecasts are made during theses planning and procurement processes. However, the IEPR forecast serves as the “reference” and is acknowledged as the primary source of information.

Procurement Plan (LTPP)[5] and Resource Adequacy (RA)[6] proceedings, and the CAISO's Transmission Planning Process (TPP)[7] -- the processes in which the state's IOUs and/or Participating Transmission Owners (PTOs) plan for and procure resources and demand-side investments necessary to ensure their customers receive reliable service at low and stable prices.[8]

The IEPR forecast is "statewide," meaning that it represents the sum of multiple service territories that comprise the state's total demand. However, breakouts are provided for major utility service territories and transmission zones. The utilities produce demand forecasts for their own service areas. These are submitted and discussed during the IEPR proceeding, as part of the process for developing a publicly vetted IEPR forecast. The utility demand forecasts are used for a variety of internal planning purposes, and to inform proposals and comments submitted by the IOUs in the resource planning proceedings enumerated above.

The CPUC established the biennial LTPP process in 2004, following the California energy crisis.[9] During the first LTPP, the IOUs based procurement plans on their own demand forecasts. In the second LTPP cycle, the CPUC specified that going forward, the IEPR forecast should be used as the reference forecast – the basis for resource procurement.[10] However, CPUC intended to base resource procurement decisions on "managed" forecasts, that is: forecasts decremented to reflect the effects of new, and more aggressive, demand-side policy initiatives not included in the official IEPR forecast. A "managed" demand forecast is meant to convey a forecast that is different from "business as usual" through the explicit use of program activities to adjust demand downward. Such adjustments could include any demand-side policy initiatives: energy efficiency, distributed generation, and other types of response considered demand adjustments rather than supply-side resources.

A key issue, though, was how to adjust the IEPR forecasts to reflect the effects of the new demand-side policy efforts. The base IEPR forecasts are specifically constructed to represent a "business as usual," rather a speculative forecast. They do incorporate "committed" programmatic and policy initiatives – programs that are authorized and funded, and/or approved codes or standards that have taken effect.[11] To develop managed forecasts for LTPP purposes,

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[5] http://www.cpuc.ca.gov/PUC/energy/Procurement/LTPP/

[6] http://www.cpuc.ca.gov/PUC/energy/Procurement/RA/

[7] https://www.caiso.com/planning/Pages/TransmissionPlanning/Default.aspx

[8] The three largest IOUs, Pacific Gas & Electric Company (PG&E), San Diego Gas & Electric Company (SDG&E) and Southern California Edison supply approximately 75-80% of the electricity for the state, and together with Southern California Gas (SCG), about the same percentage of natural gas. Approximately forty-six POUs provide the remaining power for the state. The IOUs are governed by the CPUC. Procurement decisions for POUs are handled through separate processes, depending on the utility. Meanwhile, the CAISO manages the flow of electricity for about 80 percent of California and a small part of Nevada--all of the IOU territories and some POU service areas. (There are some pockets where local public power companies manage their own transmission systems.) The IOUs are the largest participating transmission owners (PTOs), although there are others. With respect to energy efficiency and resource procurement, this paper focuses primarily on the IOU processes, both because they account for the bulk of the state's activity, and since the POU processes are individualized and would be difficult to describe succinctly. However, the POU service territories are included in planning activities governed by the Energy Commission and CAISO, and the POUs participate in the DAWG.

[9] http://en.wikipedia.org/wiki/California_electricity_crisis

[10] The concept of the IEPR forecast as the reference also applies in RA and TPP. The DAWG came about through LTPP so LTPP is discussed here.

[11] "Committed" impacts also include price and other market effects not directly related to a specific initiative. "Committed" efficiency also includes the persisting effects from efficient measures that have already been installed since those measures save energy over their lifetime. Similarly, approved standards that affect new buildings,

the IOUs were asked to adjust the IEPR forecast for their service territories, incorporating analyses each utility had prepared to assess demand-side resources (primarily energy efficiency) expected to occur in their service territories during the forecast period.

In order for this analysis to work, it would have been necessary to identify impacts included in both the IEPR forecasts and the IOU assessments, and back out any double-counting. However, since the IEPR forecast and the utility estimates had been prepared with different starting points and assumptions, it was difficult (and within that LTPP time frame, impossible) to determine the degree of overlap, if any. Instead, the CPUC settled on negotiated estimates for energy efficiency in each service territory, aiming to improve the process going forward (see Jaske and Kavalec 2010).

Soon thereafter, the Energy Commission's IEPR committee conducted a workshop to follow up. It decided to devote attention to several closely related topics over the next biennial IEPR cycle (2008-2009), using the DAWG as the vehicle for interaction between stakeholders. Key goals for the DAWG included:

- Improving estimated impacts of energy efficiency within the demand forecast and attribution to motivating forces, such as price response, market effects, program participation, requirements of standards, etc.;
- Creating a new capability to project near-term program impacts incremental to the Energy Commission's demand forecast; and
- Creating new capability to project long-term impacts from portions of energy efficiency potential identified as achievable under various program designs (California Energy Commission 2008).

The DAWG has now been active for three biennial IEPR cycles (2008-2009, 2010-2011, and 2012-2013); 2014-2015 is its fourth cycle.

Structure

The DAWG's structure, purview and responsibilities have evolved over time, in particular as the DAWG has expanded to include demand-modifiers other than energy efficiency. Its current configuration is described below.

<u>Organization:</u> The DAWG meets either as the full working group, where multiple and/or crossover topics are addressed, or in subgroups, colloquially called the "Pups:"

- Demand Forecasting Subgroup -- demand forecasting models, methods, processes and results, and methods for including demand-modifiers; [12]
- Energy Savings[13] Subgroup -- energy efficiency data, forecasts, potential and goals, program and policy developments, and the effects of existing or anticipated state, local and federal codes and standards;[14]

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equipment and appliances for the lifetime of those measures and also affect new buildings, appliances and equipment associated with future stock turnover are considered "committed."

[12] The Energy Commission retains an Expert Panel to provide review and input on demand forecasting models, methods, processes, results, data, comparisons, and other issues including methods for forecasting demand-modifying resources. Members of the Expert Panel often attend DAWG and/or Pup meetings.

- Distributed Generation Subgroup -- [customer-side] distributed generation data/outputs, forecasts, potential and goals, program and policy developments including tariff structures that affect distributed generation adoption
- Demand Response Subgroup – demand response data/outputs, forecasts, potential and goals, program and policy developments.

Demand response represents an interesting case in non-event-based demand response (e.g., rate/tariff based programs and initiatives) has been reflected as a demand modifier in resource planning, whereas event-based demand response has been reflected as a supply resource. Even so, the distinction can be blurred — e.g. event-based day-ahead critical peak pricing. However, the distinction between demand-modifying versus demand response counted as supply is evolving. More of the resource will be now be treated as a demand modifier. The DAWG has initiated a Pup to discuss demand response forecasting and will continue these conversations in the 2014-2015 IEPR cycle.

Some subgroups and members are more active than others, depending on their needs, priorities and preferences. The Pups are more akin to "topic areas" than "groups" since all DAWG stakeholders are invited to attend when public meetings and presentations are held. However, members tend to sort themselves into groups that correspond to the Pups.

Topics identified with one Pup or another do cluster in particular subject areas. But the singular purpose of the DAWG is to provide a venue to facilitate interaction between groups and organizations that contribute to one-another's processes but did not previously have effective opportunities to coordinate. In that sense, all of the issues addressed by DAWG are selected because they contain crossover elements relevant to demand forecasting, resource planning and procurement and one or more of the subgroups oriented around particular demand-modifying activities.

Leadership: The DAWG Executive Steering Committee (Executive Committee) include Energy Commission staff (Demand Forecasting and Energy Efficiency), CPUC staff (LTPP; RA; Energy Efficiency Planning & Policy; Energy Efficiency Measurement & Verification (EM&V)); and Distributed Generation) and CAISO Regulatory staff. The Executive Committee meets regularly, and initiates technical conversations on emerging topics to develop plans and presentations for the DAWG.

Participants: In addition to the regulatory agencies listed above, members include the IOUs, POUs, and a number of other organizations such as ratepayer, industry and environmental advocates, educational and research institutions, and other interested professionals. Public meetings are open to stakeholders with technical or policy interests in subject matters pertinent to the DAWG.

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[13] The term "Energy Savings Subgroup" rather than "Energy Efficiency Subgroup" was chosen specifically to convey the notion that "savings" could include reductions in consumption due to either energy efficiency or energy conservation, or both.

[14] The Energy Commission was established in 1974, and two of its six basic responsibilities are: forecasting future energy needs and promoting energy efficiency and conservation by setting the state's appliance and building efficiency standards. Since these functions evolved together, the IEPR forecasting models have been built from the beginning to efficiently model the effects from codes and standards. As a consequence, energy savings from codes and standards are more straightforward to model in the IEPR forecast. But determining how anticipated changes should be captured and expressed, and staying abreast of new developments are both important for DAWG stakeholders.

Agenda-setting: The DAWG priorities are established for each IEPR cycle with input from the Executive Committee and the DAWG, though priorities can be, and often are modified to address new or evolving issues.

Functions: the DAWG is a working group, not a party in regulatory proceedings. Rather, it is a forum that facilitates discussion and understanding of relevant topics and stakeholder needs or positions. These discussions are beneficial, and serve to identify solutions or close gaps between initial positions. However, members that are also parties to a given regulatory proceeding submit comments for the record on their own behalf, if they choose to engage. These comments are based on their own internal organizational needs, policies and preferences.

Decision-makers do often request that certain topics or processes are publicly vetted through the DAWG before being officially presented for comment in regulatory proceedings. On occasion, decision-makers seek input directly from the DAWG – information summarizing the group's overall consensus on key themes, and items wherein opinions are divided. These requests are informational in nature, but do supply insight for higher-level policy development.

Responsibilities: Strictly speaking, "the DAWG" itself does not produce any documents, analyses or other work products. Rather, DAWG members use the forum as a venue to communicate and coordinate with one another. This coordination can influence their own internal work or processes, joint products or processes with one or more partners, or all of the above.

Voting Structure: The DAWG itself is not empowered to, and does not endeavor to make decisions that require a vote. The DAWG offers members a forum to discuss topics or processes involving shared interests, information, data, policies or roles. The working group affords them opportunities to make arrangements that facilitate these efforts. To that extent, members' preferences or informal "votes" do influence the nature of agreements between them. But there is no actual "voting."

DAWG School: Lessons Learned

The DAWG was originally established to improve methods and processes for incorporating energy efficiency impacts into demand forecasts, which in turn, serve as the basis for resource planning and procurement. Leaving aside minor exceptions, e.g., for hard-to-reach customers, the entire rationale for ratepayer- and publicly-funded energy efficiency investments is founded on the notion that the efficiency captured by those investments should be cost-effective. The cost for a unit of procured efficiency should be less than or equal to the cost avoided for supplying the energy that would otherwise have been consumed. From a ratepayer and public perspective, there is not much point in funding energy efficiency unless the savings flow through to resource planning and procurement.

In California, the IEPR demand forecasts are the mechanism through which energy efficiency can affect resource planning.

California's experience is typical, in that energy efficiency impacts had "flown under the radar" for many years. Compared with overall procurement and infrastructure requirements, the expenditures and effects of energy efficiency were *de minimus*. Although some efficiency impacts eventually made their way into resource planning processes through various mechanisms, there were gaps and inconsistencies. Then, about ten years ago, ratepayer expenditures on, and expected load impacts from efficiency programs skyrocketed. Even though energy efficiency expenditures are still small relative to overall procurement, they have become large enough, and the expectations are high enough, that it is critical for these processes to coordinate.

This section presents some of the issues that have arisen in the DAWG, progress-to-date and lessons learned, focusing on takeaways and insights relevant to energy efficiency.

Demand Forecasting Methods and Models

There are two basic approaches to modeling energy demand: end-use forecasting ("bottom-up") and econometric forecasting ("top-down"). (A third method, statistically adjusted engineering, blends elements of both.) These modeling approaches require different analytic methodologies and data in general, and to account for demand reductions from energy efficiency.

End use models are technology based, blending, for a given technology, estimates of appliance stock, unit energy consumption characteristics, hours of operation, and rates of adoption and replacement in order to paint a picture of total energy consumed by that technology over time. This structure allows forecasters to explicitly account for historical and future impacts of codes and standards, efficiency programs and naturally occurring conservation. These are at times difficult to separate, but it is at least possible to be clear regarding adjustments that are made. End-use models provide a wealth of information, and allow forecasters to independently develop projections for end uses based on demographic and equipment trends and expectations. For end-use forecasting models, historical efficiency program estimates must be specified explicitly, either through a model adjustment or through post-processing of model results. This specification is required since the end-use models must begin with a realistic "backcast," or simulation of historical consumption, to ensure a reasonable forecast (Kavalec and Schultz 2011).

The Energy Commission's IEPR forecast is primarily an end-use forecast. In the 1970s and 1980s, it was also common for utilities to use end-use forecasting. However, collecting and maintaining the data needed to operate these models is difficult and expensive. As a result, many utilities now use econometric models.

Econometric models attempt to quantify the relationship between the parameter of interest (energy consumption) and a relatively small number of factors that affect overall consumption, for example economic and demographic drivers, weather, rates, and time trends. Econometric models operate off of actual historical consumption and therefore incorporate all historical load impacts from codes and standards, energy efficiency programs, and naturally occurring savings in the last historical (or base) year and forward into the historic data used to derive the model. No specification of historic energy efficiency program savings is required to produce a forecast (Kavalec and Schultz 2011).

Econometric models project a trend that captures the amount of energy efficiency in the historic data used to fit the model. That is: the average weighted amount of energy efficiency over the historic period is expressed into the forecast period, as a trend. If the level of efficiency evident throughout the historic period is expected to continue into the forecast period, then no additional adjustments are necessary.

But many econometric forecasting models use 20 to 30 years of historical data. In California, (and elsewhere) energy efficiency expenditures and impacts have increased drastically in recent years, and are likely to rise even higher. So the efficiency trend "baked in" to the historical data, the "average weighted amount of efficiency over 20-30 years" is not always a good predictor for the average weighted amount in the forecast period.

Some modelers use post-processing to account for additional levels of efficiency expected to occur during the forecast period. But only the expected efficiency above and beyond the “baked in” trend needs to be added -- not all of the new program (and/or codes and standards) impacts expected to occur in the forecast period. There are several analytic approaches to choose from, for example backing out the efficiency trend, developing model specifications, projecting forward and then subtracting historical and expected efficiency. Other options include adding a coefficient for program expenditures or using permutations of these methods. But importantly “The forecaster has no direct interest in the accomplishments of individual programs or the first-year impact of programs. The relevant question involves how much energy sales are reduced in each year from the combination of all programs run from a point in time” (Itron 2010). In other words, energy efficiency impacts are characterized only in broad terms in econometric models, if at all. Utility forecasters using econometric models need very little information regarding historic or expected impacts from energy efficiency programs. At most they might use total savings by sector, and perhaps expenditures.

Initially, few DAWG members from the energy efficiency organizations were aware that the Energy Commission and utilities use entirely different approaches for forecasting energy demand. Also, they tended to be more familiar with end-use forecasting, since energy efficiency potential studies use end-use methods. Participants coming from energy efficiency backgrounds were often surprised to learn how little of the actual energy efficiency data the utility demand forecasters ordinarily use in their econometric models. In fact, some of the forecasting models do not explicitly consider energy efficiency at all.

Data Availability, Interpretation and Analytic Purpose(s)

One of the most important functions of the DAWG has been to facilitate data sharing and interpretation. DAWG members are often called-upon to use one another’s data. Identifying which data are available and appropriate for a given purpose, and transmitting data and analyses between organizations is important. But it’s even more important for organizations at each step of the way to understand data they are using, and the needs of the clients for whom the analysis is being produced. Data and analyses circulate back and forth between all of the member organizations. Inputs or data developed from one process feed into processes at other organizations, which in turn feed back to the original organization in another form. “Clients” for a given set of data or analyses become “providers” for a different set, which, in turn feed back to the original clients.

The DAWG has been useful for the staff who contribute to this circulating workflow. As one of the Energy Commission’s forecasters commented: “I know that I have benefited from a better understanding of the needs of our forecast clients (CAISO/CPUC-LTPP, etc.). In dealing with a large and complex organization like the CPUC, it helps to have their staff understand what we need so that they can give us a heads up when a change is coming down the pipeline that will impact our analysis.”

On another front, it has been as useful for DAWG members, particularly the Energy Commission and CAISO, to become more familiar with energy efficiency EM&V and reporting conventions and terminology. For example, CPUC and the IOUs produce different data streams characterizing program accomplishments in terms of “net,” “gross,” “*ex ante*,” “*ex pos*t,” and, in California “*ex post* reported,” “*ex post* verified,” “*ex post* evaluated” and so forth. Few people outside the immediate energy efficiency community tend to be aware of these distinctions.

Another benefit of these discussions is that internal conversations between the energy efficiency and resource planning organizations have helped to boost confidence in the efficiency estimates.

Additional Achievable Energy Efficiency (AAEE)[15]

From its inception in 2008, a key objective for the DAWG has been to produce a stream of demand-side impacts that are incremental to the IEPR forecast (Kavalec and Gorin 2009; Kavalec, et al 2012; Kavalec et al 2014a and 2014b). The Energy Commission prepares this analysis in consultation with other DAWG members and stakeholders. The "Additional Achievable Energy Efficiency (AAEE)[16]" analysis provides annual estimates of energy efficiency savings (from programs, codes and standards), likely to occur, but not "committed" according to the criteria for inclusion in the base IEPR forecast. There are several AAEE forecast scenarios. These scenarios can be combined with different scenarios in the IEPR base forecast, as needed, to produce managed demand forecasts for different regulatory purposes.

The AAEE estimates are developed primarily using data from CPUC's energy efficiency potential and goals studies[17] (Navigant 2012 and Navigant 2014), which in turn, were developed in coordination with the Energy Commission's IEPR forecasts. Energy efficiency potential and goals for the POUs also come into play. The DAWG serves as the informal public forum for developing and vetting both the AAEE and the energy efficiency potential and goals analyses. (At key junctures, these analyses are formally presented and adopted in their respective regulatory proceedings.)

With each successive cycle, the IEPR and energy efficiency potential forecasts have been better-harmonized, to the degree possible, leading to an AAEE analysis that is coordinated with both. This improves the process for developing managed forecasts and the quality of those forecasts. The IEPR forecast and energy efficiency potential and goals analyses now coordinate very well on inputs including:

- Economic/demographic data
- Building stock and vintage
- Historic program accomplishments
- Projections for the current ("committed") energy efficiency program cycle and adopted ("committed") codes and standards
- Unit energy consumption/end-use intensity
- Rate forecasts
- Forecasts for emerging technologies
- Adjustments for codes and standards taking effect over the forecast period

A related issue raised in a variety of DAWG contexts has to do with development and interpretation of energy efficiency goals, and how those goals should be handled in resource planning. The CPUC's current energy efficiency goals, and other efficiency goals for the state overall were crafted with the intent that they are "achievable." In some instances energy

[15] http://www.energy.ca.gov/2013publications/CEC-200-2013-005/CEC-200-2013-005-SD.pdf
[16] Formerly known, in the 2009 and 2011 IEPR cycles, as the "incremental uncommitted energy efficiency projection."
[17] http://www.cpuc.ca.gov/PUC/energy/Energy+Efficiency/Energy+Efficiency+Goals+and+Potential+Studies.htm

efficiency goals or targets are specifically crafted as "aspirational" or "stretch" goals, and sometimes not. Or, some stakeholders view might view certain goals as "aspirational" even if others do not. Demand forecasters from several different organizations mentioned feeling conflicted between their fiduciary responsibility to produce "accurate" forecasts and management or regulatory pressure to include aggressive policy-driven goals in forecasts intended for use in resource planning. Offering scenarios for both the IEPR and AAEE forecasts has been helpful in bridging these different perspectives. The scenario approach affords resource planners opportunities to select different combinations suited for different planning purposes.

Recent Developments

In early 2013, the California State Senate Committee on Energy, Utilities and Communications formalized its request for the kind of interagency coordination that had already been taking place informally through the DAWG. The Committee directed the Chairs of the three regulatory agencies to provide joint specific recommendations regarding how to "improve the demand forecast and procurement planning process that your respective entities conduct to more efficiently reach agreement on how to account for reduced demand from energy efficiency" (Padilla and Fuller 2013).

This coordination had been underway more closely between the Energy Commission and CPUC, with some CAISO involvement. CAISO is perhaps the most cautious of the regulatory organizations in terms of aggressively incorporating expected energy efficiency impacts into its annual transmission planning activities. Transmission planning requires assessments with spatial and temporal constraints not currently, or at least not well reflected in energy efficiency program reporting and forecasting. Transmission planners need to know where, when, at what time of day in what season energy efficiency impacts will occur. Efficiency program savings have traditionally been reported at the service territory level, and to some degree in California, at the climate zone level. But California's largest IOUs contain hundreds of planning nodes from a transmission planning perspective.

For the last several cycles, the Energy Commission has worked with its sister agencies and the IOUs, through DAWG, to characterize AAEE estimates at the nodal (or "busbar") level, in order to provide a managed forecast for TPP. The analysis is currently based on "top down" methods, sharing out AAEE estimates developed at the climate zone level to represent busbar impacts. This year, using the IEPR and AAEE scenarios, the CAISO plans to use "mid-AAEE estimates for systemwide planning studies, and the "low-" estimates for localized studies.

The DAWG is continuing to discuss options for developing energy efficiency program reporting, and potential and goals estimates at increased levels of disaggregation. It might be possible to report and forecast certain efficiency impacts by zip code, or, maybe even by busbar. It may also be possible, in theory, to characterize those impacts in terms of 8760 loadshapes. But this conceptual approach raises significant concerns about data fidelity. The nature of the resource, EM&V and reporting processes may not lend themselves to bottom-up data development at this level of disaggregation. In any event, these issues are receiving a lot of attention during the current DAWG cycle, and probably in years to come.

Conclusions

The rationale for ratepayer- and publicly-funded energy efficiency investments is founded on the notion that the efficiency captured by those investments should be cost-effective.

The cost for a unit of procured efficiency should be less than or equal to cost that is avoided for supplying the energy that would otherwise have been consumed. From a ratepayer and public perspective, there is not much point in funding energy efficiency unless the savings flow through to resource planning and procurement.

In California, the IEPR demand forecasts are the mechanism through which energy efficiency can affect resource planning. "Reference forecasts" like the IEPR forecasts are used throughout the industry, often by managing "business as usual" forecasts to include effects from demand modifiers like energy efficiency expected to occur in the forecast period.

It is in everyone's interest to ensure these energy efficiency savings flow through to resource planning and procurement. In order to do this effectively, the energy efficiency community needs to engage more fully with resource planners and processes.

The DAWG has been well received in California, and continues to serve as a venue to improve processes for integrating demand-modifying activities into resource planning. Each cycle, DAWG members have been better able to synchronize data, work products and workflow, and to understand one another's needs. Lessons from the DAWG may be useful to states or jurisdictions seeking to ensure that energy efficiency is properly reflected in resource planning decisions.

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