STAFF GUIDANCE FOR STRAW PROPOSALS ON:

LOAD IMPACT ESTIMATION FROM DR

AND

COST-EFFECTIVENESS METHODS FOR DR

Prepared for:

Energy Division, CPUC
Demand Analysis Office, CEC

Contacts:

Dorris Lam, CPUC
David Hungerford, CEC

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1. Introduction

This document is intended to provide guidance from staff to parties submitting straw proposals for load impact protocols and demand response (DR) cost effectiveness methodologies as envisioned in the Assigned Commissioner and Administrative Law Judge's Scoping Memo and Ruling (ACR),[1] for the Rulemaking Regarding Policies and Protocols for Demand Response Load Impact (LI) Estimates, Cost-Effectiveness (CE) Methodologies, Megawatt Goals and Alignment with the California Independent System Operator Market Design Protocols (R. 07-01-041).[2]

The balance of this introduction section summarizes the Phase 1 activities. The remainder of the document is organized as follows:

- Section 2 – Background: This section reviews the context of this rulemaking in relation to other proceedings that are underway in California.

- Section 3 – General Issues: Provides a discussion of some themes that affect both the LI and CE straw proposals.

- Section 4 – Guidance for Straw Proposal on Load Impact Estimation:
  - Provides an overview of key issues in load impacts.
  - Describes the desired organization for the straw proposal.

- Section 5 – Guidance on Straw Proposal for Cost-Effectiveness Methods:
  - Provides an overview of key issues in cost effectiveness issues.
  - Describes the desired organization for the straw proposal.

[1] Assigned Commissioner and Administrative Law Judge's Scoping Memo and Ruling, April 18, 2007. R. 07-01-041.
[2] Order Instituting Rulemaking Regarding Policies and Protocols for Demand Response Load Impact Estimates, Cost Effectiveness Methodologies, Megawatt Goals and Alignment with the California Independent System Operator Market Design Protocols filed January 25, 2007. R.07-01-041.

The schedule for Phase 1 as set forth in the Scoping Memo is as follows:

DATE	ACTIVITY
May 3-4, 2007	Workshops on Load Impact estimation protocols, other Cost Effectiveness inputs, and Cost Effectiveness methodology to receive party input.
May 18, 2007	Release staff guidance for LI and CE methodologies.
July 13, 2007	LI and CE "straw proposals" filed: one of each by joint IOUs, others by additional parties if desired.
July 19-20, 2007	Workshop to present straw proposals and answer questions.
July 27, 2007	Comments filed on straw proposals to inform workshops.
August 1-3, 2007	Workshops: August 1 on LI, August 2-3 on CE to discuss and resolve areas of disagreement.
August 22, 2007	Post-workshop Reports filed.
August 24, 2007	Last day to file a request for evidentiary hearings.
September 19, 2007	Workshop reports (by Energy Division) with recommendations.
October 5, 2007	Comments on workshop report filed.
January 2008	Proposed Decision.
February 2008	Earliest possible Commission vote on LI and CE methods.

The workshop mechanism was chosen rather than evidentiary hearings because the parties at the Prehearing Conference (PHC) expressed the "nearly uniform view that workshops are the most appropriate venue for resolving the technical issues."[3] The ACR (scoping memo) calls for this Staff guidance to indicate what should be contained in the parties' straw proposals. A Phase 1 workshop was held on May 3 and 4, 2007. Participants in that workshop commented

[3] ACR at 13.

on the issues to be resolved for both LI and CE efforts. A schedule modification and phased approach was suggested by the utilities, however, staff concluded that the schedule set out in the ACR would remain in effect unless changed by a subsequent Commission Ruling in response to a motion by a party.[4]

Concern was expressed about the ability to respond meaningfully to all of the issues implicated by these topics. Thus, this staff guidance is intended to provide sufficient focus to narrow the scope of work to be undertaken in creating straw proposals without being overly prescriptive, i.e., specific methodological choices are left to the authors of straw proposals. Staff also notes that while this guidance document and the responsive straw proposals must represent all of the issues to be resolved in this phase of the proceeding, it is recognized that in some instances, interim values or methods may be necessary. Where interim inputs are proposed, suggestions for specific additional steps and considerations to move past these interim values are to be included in the straw proposals.

2. Background

Staff recommended "that the Commission conduct a formal proceeding to develop load impact protocols for DR programs, develop a cost effectiveness methodology for DR programs," based on work product and workshops held in response to D.05-11-009, resulting in the current rulemaking.[5] The OIR recognizes that this effort will build on work already begun and that there is the potential for overlap with other proceedings.[6] To avoid unnecessary overlap between proceedings, it may be necessary to adopt interim methods with regard to some CE issues.

2.1 Policy Background

Consistent with the State's Energy Action Plan II (EAP II) and articulated resource strategy and "loading order," the Commission has been working to "improve the role of DR

[4] Participants and workshop attendees included representatives from PG&E, SCE, SDG&E, CAISO, TURN, The Energy Coalition, EnerNOC, SMUD, and Comverge. Other participants joined by phone.
[5] OIR.07-01-041 p. 3. In total, four goals are set for the rulemaking: 1) Establish a comprehensive set of protocols for estimating the load impacts of DR activities; 2) Establish methodologies to determine the cost-effectiveness of DR activities; 3) Set DR goals for 2008 and beyond, and develop rules on goal attainment; and 4) Consider modifications to DR activities needed to support the California Independent System Operator's (CAISO) efforts to incorporate DR into market design protocols. Id at 1.
[6] R.02-06-001.

programs in meeting California's energy needs."[7] The 2006-08 DR programs have been authorized, and two ACRs have directed augmentation of these efforts. The joint Energy and Public Utilities Commissions have also held joint workshops to "investigate opportunities to capture greater benefits from such programs" and to discuss the barriers to achieving the state's demand response goals."[8]

Currently in California, DR activities are typically categorized based on whether the intent is "to address spikes in market prices (day-ahead/economic DR) or to relieve threats to system reliability (day-of/emergency DR)."[9] However, in drafting this guidance on the LI and CE efforts, the Staff desires, consistent with the OIR, to consider forward facing taxonomies that have flexibility to work with the MRTU. This effort should "improve the CAISO's implementation of MRTU."[10]

2.2 Relationship to other Proceedings

At the close of R.02-06-001, Decision D.05-11-009 recognized the need for additional work to integrate DR activities into the resource planning process, and evaluate and measure the effect of DR activities. As the methods for measuring load impacts and assessing cost-effectiveness are developed, it is important to recognize that this work may inform or be informed by other proceedings. For example, currently, dispatchable DR is considered to be a supply-side resource for purposes of calculating resource adequacy requirements, while non-dispatchable DR is considered to be a reduction from load forecasts. The resource adequacy proceeding R.05-12-013 is exploring improvements to forecasting mechanisms related to DR resources.[11]

The LI protocols developed as the result of this rulemaking may resolve some of the concerns raised with regard to the measurement of DR effects for the purposes of promoting resource adequacy. Other proceedings may inform this effort as well.[12] However, in most areas

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[7] Ibid. and R.02-06-001
[8] "Notice of Joint Committee Workshop on California's Demand Response and Load Management" held April 19, 2007.
[9] OIR.07-01-041 p. 2.
[10] OIR.07-01-041 p. 5.
[11] OIR.07-01-041 p. 6.
[12] See for example, Proposed Decision, Opinion On Future Policy And Pricing For Qualifying Facilities, April 24, 2007. In Order Instituting Rulemaking to Promote Consistency in Methodology and Input Assumptions in

in which the Commission may ultimately rely on other proceedings to determine final methodologies and values, the ACR clearly contemplates that the straw proposals developed in this proceeding suggest interim methods and inputs.[13] The exception is in the estimation of avoided costs. Staff suggests the basis of an interim methodology for use in these straw proposals in order to avoid the contentious and time-consuming litigation likely to follow if parties are asked to develop final methods for avoided cost calculation. This suggested interim methodology is discussed in section 5.4 and is intended to act as a placeholder to enable some use of the overall CE framework developed through this proceeding until there is an appropriate time and venue to develop an avoided cost methodology.

2.3 Relationship to CAISO needs and MRTU

Following the Federal Energy Regulatory Commission's (FERC) conditional acceptance of the Market Redesign and Technology Upgrade (MRTU) on September 21, 2006, substantial effort has been allocated to enhancing grid reliability and designing ISO markets. Two key issues pertaining to this process have been identified:

1. Identifying potential CAISO markets that can accept DR bids.
2. Identifying the optimal operating system needs that can take full advantage of the attributes of DR options.

The CAISO envisions providing full support to DR amidst the MRTU process. Ultimately, DR is anticipated to compete directly with conventional generation resources in the market on a level playing field. Both the LI and CE protocols will likely need to fit with the planned CAISO markets and coordinate the straw proposals with the CAISO market planning and zonal requirements. The CAISO plans on a stakeholder process to address the State's policy objectives in relying on DR, however, specific product definitions and dates have not yet been set.[14]

Commission Applications of Short-Run And Long-Run Avoided Costs, Including Pricing for Qualifying Facilities -- Rulemaking 04-04-025.

[13] ACR at 7.

[14] CAISO Five Year Business Polan, 2007-2011, April, 19, 2007, available at: http://www.caiso.com/1bbf/1bbfb29771f52.pdf?ht=five%20year%20plan%20five%20year%20plan%20five%20year%20plan%20five%20year%20plan

3. General Issues for both Load Impact (LI) and Cost-Effective (CE) Methods Straw Proposal Guidance

This section discusses several over-arching issues that impact Staff guidance on the straw proposals for both the Load Impact (LI) and Cost-Effective (CE) methods. These are general framework issues for the straw proposals and are drawn from the ACR Scoping Memo[15] and the prior CPUC documents. D.05-11-009 identified a need to develop measurement and evaluation protocols and cost-effectiveness tests for DR. This decision with respect to LI methods stated that:

> *Unlike energy efficiency, which has a long history of success, adopted measurement protocols, and is well integrated into the resource planning process, demand response programs have a shorter history, are not well integrated into the planning process, and do not have adopted measurement and evaluation protocols.*

With respect to CE methods:

> *An industry accepted methodology for evaluating cost-effectiveness of demand response programs has not yet been established.*

The D.05-11-009 recognized that new work is needed on these issues and that the development of both load impact protocols and cost-effectiveness methods will need some innovation over the procedures and process used for energy efficiency programs.

3.1 Progress on LI and CE Issues and Methods – Methods and Values in the Straw Proposals, Interim Approaches, and Potential Need for Further Work

The timeline for these straw proposals is such that it may be difficult to resolve all of the issues targeted for Phase 1 of R.07-01-041:

- OIR Goal 1: Establish a Comprehensive Set of Protocols for Estimating the Load Impacts of DR Programs.
- OIR Goal 2: Establish Methodologies to Determine the Cost-Effectiveness of DR Programs.

[15] Assigned Commissioner and Administrative Law Judge's Scoping Memo And Ruling, April 18, 2007. R. 07-01-041.

The timeline required for producing the straw proposals may challenge the joint utilities development of comprehensive straw proposals in terms of fully developing the LI protocols and CE methods. However, if methods are proposed in the interim, it is important that the additional work, where needed, be identified. The scoping memo and ruling states:

> *In addition [to the overall CE framework], the final product should recommend values for the inputs, or at least recommend methodologies for determining the value of the inputs. If further work is needed to develop satisfactory inputs, the Commission may consider relying on interim values or methodologies (e.g., estimates used in other proceedings) until additional work can be undertaken. If this appears necessary, parties should address what further work is needed*. (ACR, p.7)

Based on comments at the May 3-4 workshop and materials provided by the joint utilities at the workshop, there was concern over whether these issues could be resolved in the time frame specified for the development of the straw proposals. However, it is important that progress is made on these issues. As a result, interim methods may be proposed that are viewed as improvements over current procedures, but they should be accompanied by a discussion of the reasons why the interim methodology is suggested and description of "what further work is needed" to develop a new methodology.

In its prehearing conference statement, Southern California Edison (SCE) indicated that reaching resolution on CE protocols for DR is critical to timely development of utilities' 2009-2011 DR program portfolios and that the LI protocols are needed as inputs to the CE methods.[16] Delay in resolving the cost-effectiveness issue may affect the ability of the utilities to get timely resolution of their 2009-11 DR program portfolio applications. Timely resolution of the 2009-11 program portfolio applications is vital to enable the utilities to maximize the benefits of the DR activities for summer 2009 and beyond.

The need to move ahead with the design of cost-effective DR portfolios argues for an approach to seek as much resolution on the issues as is possible in the straw proposals, recognizing that some issues will be difficult to resolve in this time frame and that the

[16] Prehearing Conference Statement of Southern California Edison Company: Order Instituting Rulemaking Regarding Policies and Protocols for Demand Response Load Impact Estimates, Cost-Effectiveness Methodologies, Megawatt Goals and Alignment with California Independent System Operator Market Design Protocols, April 9, 2007. R.07-01-041.

specification of interim values and methods may be required, with the identification of the additional work that is needed.

3.2 DR Activities to be Addressed in Straw Proposals – Emphasis on the DR Portfolio including Pricing Options

Staff takes the following position, consistent with that in the April 18th ACR (the scoping memo in this proceeding), concerning the range of DR activities that should be addressed. The ACR indicates that:

> *DR activities, as defined in the OIR, may utilize many different strategies, including (but not limited to) reliability programs, the use of incentive payments for participation, and/or dynamic pricing or other time-variable tariffs. To the extent possible, the results of this task should address the broad variety of DR approaches, including current and anticipated activities. (p. 5-6)*

In this context, Demand Response is defined as "changes in electricity consumption by customers in response to signals in the form of electricity prices, incentives, or alerts during periods when the electricity system is vulnerable to extremely high prices or compromises to reliability." (R.07-01-041, p. 2.)

At the May 3-4 workshop, the utilities submitted a document entitled "*Joint PG&E, SCE, and SDG&E Input for CPUC Staff Guidance for Straw Proposals on DR Cost Effectiveness Methods*," dated April 27, 2007.[17] In this document, the joint utilities recommended that:

- Guidance should cover the straw proposal on cost effectiveness methods for only event-based DR activities and products.
- Separate guidance should be provided in the subsequent straw proposal in this OIR on cost effectiveness methods for dynamic pricing based DR activities.

The Staff guidance on this issue is that the approaches developed in the straw proposals cannot be limited to event-based DR activities and products. The straw proposals should have time-differentiated rates and/or dynamic pricing options as a key focus.

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[17] This document was provided to the Service List in R.07-01-041 by PG&E via e-mail on May 7, 2007.

The justification for this is that a long-term view of DR as a resource requires that DR pricing options be considered. These pricing options influence the behavior of customers over time as they respond to price. In addition, they influence the future growth rates in peak demand and energy that are used in planning activities to determine the appropriate set of resources needed to meet these demands. For example, the amount of dispatchable DR activities will depend on the peak demand that has to be met in the future.[18]

There is a concern that dispatchable options currently may be given greater emphasis than warranted by their long-term benefits when compared to pricing options. This may be due to utilities' familiarity with these DR options and their ability to yield quick results. However, these quick results may come at the expense of greater long-term benefits that can result from pricing options used in combination with dispatchable/event-based DR.[19] From this perspective, time-differentiated and dynamic pricing options may provide the underlying platform for the portfolio of DR activities over longer planning horizons. As a result, Staff guidance is that the dynamic pricing options and other nonevent-based pricing options need to be addressed in the straw proposals, as well as event-based DR activities and products.

3.3 Focus of LI and CE Straw Proposals should be on Resource Planning

A document provided by the joint utilities at the May 3 Load Impact Workshop under this proceeding[20] entitled "*Joint Utilities Recommendation Scope and Schedule for Protocol Development*" contained an outline that requests:

1. Guidance for monthly reporting of DR results.
2. Guidance for forecasting DR impacts for resource adequacy.
3. Guidance for forecasting DR impacts for long-term resource planning.
4. Guidance for forecasting DR impacts for operational dispatch.
5. Guidance for customer settlement baseline/methods.

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[18] The peak demand that must be met by resources will influence the CAISO markets for energy, capacity and ancillary services and requirements to meet reliability criteria.
[19] Other factors include the impacts of dynamic pricing on overall market efficiency and the fact that these DR activities are viewed as less intrusive as customers can decide on their own to curb usage in response to prices (e.g., they may choose to set-back AC usage).
[20] On May 7, 2007 this document was served by PG&E on the service list for this proceeding (R.07-01-041).

Of these five potential uses for the results of LI estimates and CE methods, the focus of the straw proposals should be on item (3) above – DR impacts for long-term resource planning. Staff believes that developing good LI estimates and CE methods that allow for appropriate resource planning will provide a foundation from which the other four items in the list can be addressed. Some adjustments may be needed, but these should follow in the later stages of this proceeding.

Staff does request a discussion of the issues and problems that the authors of the straw proposals see in moving from resource planning-based estimates of different DR activities to providing the information required by the other four listed items (other than item (3) – resource planning).

4. Guidance for Straw Proposals on Load Impact (LI) Estimation Protocols

This section provides guidance on developing straw proposals for estimating the load impacts of DR options. This is designed to meet OIR Goal 1: Establish a Comprehensive Set of Protocols for Estimating the Load Impacts of DR Programs. This guidance is not meant to foreclose options that the authors of the straw proposal believe are superior methods, but to provide some areas of focus in the development of the straw proposal.

4.1 Load Metric to be Estimated – Hourly Impacts due to DR

The load impacts to be estimated due to DR activities should be expressed in terms of MWs or kWs on at least an hourly basis (Note: In some hours, the impacts may be positive and in other hours they may be negative due to factors such as load shifting and snapback). Hourly estimates of impacts are expected to be needed for all DR options as it is expected that the CE methods will use this hourly series of impacts as an input into the benefits calculation. This approach should make the CE methods more consistent across different DR activities. If one of the straw proposals believes that hourly estimates of impacts are inappropriate for a DR option, this should be discussed in that straw proposal.

4.2 Links to EE Evaluation Protocols and Other Related Work

The EE Evaluation Protocols[21] contain information useful in estimating DR load impacts. Where appropriate, these load impact estimation protocols should augment the information in the EE Evaluation Protocols by cross-referencing appropriate issues. In general, the EE Protocols have excellent information on how to apply general methods (e.g., regression, site-specific M&V, and sampling) and on reporting, but the selection of appropriate methods for specific DR applications is likely to be specified in the LI approaches developed by the authors of the straw proposal. Also, given the focus of DR on peak load periods, there may be some differences in the specific application of methods to EE and DR impact estimation. The authors of the straw proposals are encouraged to cross-reference the EE Evaluation Protocols as appropriate for the DR estimation effort to maintain consistency across demand-side impact estimation, but the application should be appropriate to the DR load impact estimation effort.

In addition to the EE Evaluation Protocols, a number of research efforts have looked at LI estimation for DR activities. These include but are not limited to:

1. CEC Baselines Report (2003) – "Protocol Development For Demand Response Calculation — Findings and Recommendations," prepared for the California Energy Commission, Michael Messenger Project Manager, Report CEC 400-02-017F, by M. Goldberg and G. Agnew (KEMA), February 2003.

2. Evaluation Framework Report (2004) – "The California Evaluation Framework," prepared for the California Public Utilities Commission, by TecMarket Works and Team Members, Project #: K2033910, June 2004.

3. WG2 2004 and 2005 DR Evaluations – Prepared for the Working Group 2 Measurement and Evaluation Committee, by Quantum Consulting, Inc. and Summit Blue Consulting. (Available on the CEC website under Demand Response and WG2).

4. FINAL REPORT: Impact Evaluation of the California Statewide Pricing Pilot, prepared for Working Group 3 by Charles River Associates, March 24, 2005.

[21] "California Energy Efficiency Evaluation Protocols," prepared for the CPUC Energy Division by the TecMarket Works Team, April 2006.

It is expected that these documents can be cross-referenced and used to support different LI estimation methods for different types of DR activities.

4.3 Multiple Estimation Methods to Address Different DR Options

The ACR indicates that the variety of DR activities and options may require the development of more than one estimation method and protocols due to the different types of DR activities. The ACR states that it "may be helpful to categorize DR activities based on relevant characteristics and develop separate load estimation protocols for each category of activities." The ACR also goes on to state that categorization of DR activities is within the scope of this proceeding, to the extent that it assists in the development of load impact protocols. In fact, the ACR suggests that straw proposals may "clarify, supplement, or replace current distinctions between "dispatchable" and "non-dispatchable" types of demand response, and between "reliability" and "price-responsive" activities currently used in discussions of demand response (ACR, Footnote 7). This provides the opportunity for the straw proposals to develop categories of DR that are better aligned with activity objectives and aligned with LI estimation methods.

Staff believes that the best approach would be to have the authors of the straw proposals have the responsibility for the development of the categorization of DR activities to ensure alignment between estimation methods and DR types. Several taxonomies of DR activities have been developed that could be used as a starting point. The recent report on the "State of Demand Response in California" included one example of a taxonomy of DR approaches.[22]

While Staff is not proposing these as specific categories for use in the straw proposal, the listing of DR activities below do have a different focus than those used in the "State of Demand Response in California." This list below is intended to provide a sense of the diversity of categorization that is possible and to re-enforce the staff guidance that the development of LI estimation methods is likely to map to a set of DR activity categories that will need to be defined in the straw proposal. While the straw proposals should develop the DR categories and Staff are not making any specific recommendations, the types of DR activity categories might include:

[22] "The State of Demand Response in California." Prepared for the California Energy Commission. Draft Consultant Report, by Ahmad Faruqui and Ryan Hledik, April 2007. http://www.energy.ca.gov/2007publications/CEC-200-2007-003/CEC-200-2007-003-D.PDF.

Non-event based pricing DR – This category would include TOU, RTP and related dynamic pricing variants that would not be based on a called event, i.e., they would be in place for a season or a year.

Event-based pricing DR – This category would apply a set of prices that customers could respond to based on an event basis, i.e., a day-ahead call or a same-day call, possibly two hours in advance. This could include many pricing variants that include, as examples, a critical peak price for a time period in a called event day, or it could include a schedule of prices presented in advance and customers can contact the utility to indicate how much load they will reduce in each hour at the offered price. The common element is that these prices are tied to called events by the utility or DR administrator or other operator.

Direct Load Control DR – This activity can apply to either mass-market (e.g., AC switches) or to large customers (e.g., an auto-DR activity) where actions occur at the customer site, in response to a signal sent by an operator on called event periods.

Callable DR – This DR activity is similar to direct load control DR (above) but, in this case, a signal is sent to the customer who then initiates actions to reduce loads, often by an amount agreed to contract. The difference is that the action is not utility controlled, but is customer controlled, which might change LI impact data collection and estimation approaches.

Scheduled DR – There are some loads that can be scheduled to be reduced at a regular time period. For example, a group of irrigation customers could be divided into five segments, with each segment agreeing to not irrigate/pump on a different selected weekday. This would reduce peak load by 20% due to the increased diversity, i.e., 20% of the load is off the system every day due to these scheduled reductions.

Permanent Load Reductions and Load Shifting – Permanent load reductions are often associated with energy efficiency activities, but there can be some technologies such as demand controllers that can result in permanent reductions in peak demand. In the case of load shifting, load may be shifted permanently through the use of timers, energy management systems or through agreements.[23]

There are many possible attributes of DR activities that could be used to develop categories. These may include the time-to-call that might influence the role of a DR activity in system operations (e.g., the lead time required before a load responds – 10-minute response, 30-minute response, 2-hour response, or day-ahead notice); the availability of the load reductions (number of hours and times in a season); or the definition of a DR being a critical resource due to its location in a constrained area. These factors are clearly important aspects of valuing DR, but methods for estimating achieved MW load reductions may not be sensitive to these DR

[23] In response to queries, Staff was informed that permanent load reductions should be included in the CE method protocols. As a result, there is a need to develop impact estimates for these activities.

attributes. However, the importance of these factors in assessing appropriate methods for estimating the load impacts from a DR activity designed to meet operational or locational objectives is an area that staff hopes will be addressed in the straw proposals.

In summary, the need to align categories of DR activities with appropriate load impact estimation methods requires that the final categorization is the responsibility of the authors of the straw proposals.

4.4 Role of Ex Post and Ex Ante Estimation Protocols in Straw Proposals

Ex post LI estimates refer to estimates for a historical event or time period. These are useful in assessing whether the expected load impacts were, in fact, achieved and they can serve as the basis for developing the ex ante forecasts of load impacts where appropriate historical data exist on which to develop these estimates.

Ex ante LI estimates refer to projected load impacts from DR activities that are needed as inputs for most all cost-effectiveness assessments of DR activities within a resource planning context. Given the focus on resource planning (as discussed above in Section 3.3), staff believes that the straw proposals should develop ex ante LI estimation methods useful in CE analyses that can assess the value of DR as a resource.

This resource planning focus implies that the LI estimates need to cover an appropriate planning time horizon. As a result, there may be a need to include more explanatory variables in LI estimation methods designed for forecasting impacts. For example, AC cycling programs will have load impacts that vary with weather (e.g., on the hottest days, most AC units will be running at loadings and cycling will produce greater impacts). As a result, LI estimates for this DR activity may need to incorporate weather as a driving variable, including weather conditions that represent planning criteria, such as 1-in-10 weather, or 1-in-20 year weather, as appropriate. The goal is to develop methods that will provide the best inputs on DR activity load impacts for use in the CE assessments.

Staff recognizes the importance of ex post evaluation methods to verify whether the expected load impacts of DR activities are being realized and their use as benchmarks in developing LI estimates for resource planning. Ongoing measurement and verification of DR activities might comprise a separate set of evaluation activities valuable for updating load impact estimates, as well as assess the accuracy of participant settlement calculations.

4.5 Gross or Net LI Estimates

Staff believes that there is a need to work towards estimates of net load impacts, as changes in loads that would have occurred even if the DR activity had not taken place can not really be counted as a resource. This means that a discussion of how to approach estimates of net impacts is needed. The authors of the straw proposals should select the approach believed to be most appropriate for arriving at net load impacts. This could be a gross-to-net multiplier, but it likely will require a discussion of free riders in DR activities, and the potential for spillover (i.e., impacts due to the DR activity but that are not accounted for in DR records). Spillover can occur when participants in, for example a dispatchable DR activity, adopt behaviors that have load impacts. This could be due to changes in the way they operate their facilities or investments in additional load management/shifting technologies.

There is a need to determine what approaches make sense for estimating net LI estimates in the near term, with some approaches viewed as interim. This would be accompanied by a discussion of the research that might be needed in the future to improve on these estimates, which should be identified and discussed in the straw proposals for LI estimation.

4.6 MW Impact Estimation Methods

Staff believes that the following items should be among those addressed in the straw proposals:

a) Judgments in the straw proposals that indicate which LI estimation methods are appropriate for different DR activities. It is recognized that there may be more than one approach suitable for a given DR activity, but every type of DR activity should have at least one associated approach for determining load impacts.

b) The baselines used for each method should be discussed as they represent the load that would have naturally occurred had the DR activity not been offered. As a result, they are the benchmark against which the LI estimates are calculated. These baselines could be derived in a number of ways. The authors of the straw proposals should suggest the most appropriate baseline estimation method. As examples only, some baseline estimation methods are shown below:

i. Baselines could be calculated using pre-event representative days (e.g., highest three load days out of the prior 10 non-event days).

ii. They can be based on both pre- and post-event days to more accurately portray the naturally occurring loads on the event day, and they can be based on seasonal data where daily data for a season are used in a regression/statistical approach to estimate the impacts of all the events in a season. This would use all the daily load data as control information for event days.

Discussions of how accurately baselines can be estimated using different methods for the different DR activities should be included. In summary, the approach for estimating the baseline that is embedded in the overall method for estimating load impacts is viewed as an important component of any LI estimation approach and deserving of discussion.

c) The usefulness and role of sampling, i.e., methods that can benefit from the use of sampling should be discussed. The goal is to encourage innovative thinking on LI estimation and how data can be leveraged in the estimation process. For purposes of discussion, this might include:

i. Applications where it is impractical to obtain information on the population and a sample is required, as well as applications where a sub-sample can be drawn even if data is available on the population of participants in a DR activity.

ii. A DR activity where whole premise load data is available for the population might still benefit from a nested sub-sample where sub-metering is used on the specific equipment that is used to reduce or shift load.

iii. Proportional sampling methods may be useful to ensure adequate information on those large customers that have highly variable day-to-day load shapes as it may be difficult to establish baselines for those customers.

iv. A nested sample that provides "better" data through sub-metering could be compared to the estimates from the "good" data from whole premise meters to determine if there are any biases due to the use of whole premise data. This approach can increase the precision with which DR impacts estimates are made through the use of a ratio adjustment factors.

Staff does not have a position on the merits of these specific sampling approaches, but would encourage the authors of the straw proposals to consider innovative methods that might produce more accurate LI estimates for DR activities.

4.7 Use of Customer Specific Data to Explain Variations in LI Estimates and Improve Estimates

Staff believes that some analysis of customer specific data would be useful in assessing appropriate estimation methods. Staff recognizes that gathering a lot of customer specific data through surveys or on-site visits can be expensive and time consuming. However, Staff sees value in examining how customers' day-to-day load shapes and hourly loads might impact LI estimates and is interested in the opinions of the authors of the straw proposals on this topic.

For example, gathering day-to-day load shapes and hourly loads, if the appropriate metering is in place, would likely not be that expensive and these data could be useful in explaining how well a given estimation method works with a specific DR activity. For example, if a group of customers in a dispatchable DR activity exhibits extremely high variability in day-to-day load shapes such that the loads on any given day seem to be almost random (e.g., this could be the case with large customers where the whole premise meter captures the load data from many end-uses, or from customers that have process-based loads that they run periodically). For these customers, a representative day baseline may not be appropriate.

A mixed method evaluation for a DR activity might use different approaches for different groups of customers participating in that DR activity. For example, representative day or seasonal regression methods might be used for most participants, but a subsample of participants with highly variable day-to-day loads, may need sub-metering of equipment to obtain accurate estimates. In some cases, different DR activities may be based on customer attributes. For example, customers with highly variable day-to-day load shapes may pose challenges in verifying actual load reductions. A DR activity for this group of customers might include an approach where the connected load is monitored frequently throughout the event day (e.g., at 5-minute intervals) to ensure that load is on-line when the event is called and an actual reduction in

load occurs when called.[24] Other DR activity categories may need to be aligned with customer attributes that are linked to LI estimation methods.

Grouping customers into load shape types, e.g., weather sensitive, relatively constant across days in a month, highly variable day-to-day load shapes, might allow for better program design and DR program participation criteria in the development of future programs, which would allow for accurate LI estimates to be obtained. Excerpts from Decision 05-11-009 (p. 11-12):

1. "More precise demand reduction estimates derived from an accepted measurement methodology are a necessary prelude to performing accurate cost-effectiveness analysis."
2. "It is our belief that until the industry develops further trust that demand response will deliver demand reductions when needed, demand response will continue to be dismissed in the resource planning and acquisition process."

This implies the ability to accurately estimate load impacts with a given approved method may depend on attributes of the program.[25] If a customer's load reduction due to the DR activity simply can not be accurately estimated, then the trust that the expected demand reductions will really occur and can be verified may not be present. In the example discussed above, representative day methods may not be viable for estimating load reductions for large customers with highly variable day-to-day load shapes. For these large customers, other DR activities involving sub-metering and frequent verification of hourly loads throughout an event day may be justified by the size of the loads being impacted.

Staff believes that assessing the impacts of load shape on the accuracy of LI estimates is important[26] and may dictate the use of different estimation methods for different customer types (e.g., consistent day-to-day load shape customers versus highly variable day-to-day load shape customers). In addition, Staff requests that the straw proposals consider and discuss whether

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[24] The notice provisions for customers with highly variable day-to-day load shapes may be different from activities designed for customers that show consistent load shapes across days. This may impact the ability of different LI estimation methods to assess delivered load reductions for each group of customers.

[25] DR program design is outside the scope of the straw proposals but identification of design attributes that might influence how reliably load impacts can be estimated is part of the categorizing of DR activity types and impact estimation methods applicable to each type. Insights into how DR activity design might affect LI estimation would be useful in the straw proposals.

[26] The impacts of how customers' day-to-day variability in load shapes can influence the accuracy with which load impacts can be estimated is discussed in the WG2 Evaluation reports available on the CEC website, and referenced above.

additional customer-specific data on end-uses, occupancy, hours of operation, and business activity might be useful and worth collecting to improve net LI estimates. This may only be the case for specific customer groups in specific DR activities, or it may never be the case. For example, until interval meters are installed at all customers, it may be necessary to use surveys and/or site visits to gather customer specific data to estimate net LI impacts, i.e., address free riders and spillover.

4.8 Assessing Rigor – Bias, Accuracy, and Uncertainty

The estimation of load impacts for certain DR activities can pose different challenges than energy efficiency programs in assessing the rigor with which the load impacts are estimated. The EE Evaluation Protocols contains a good general discussion of these issues that will have general applicability to LI estimation. Overall, these issues are appropriately addressed in many applications simply through the use of sound basic practices in statistics, modeling, and engineering. However, Staff expects that there are several issues that will be useful to discuss in the straw proposals. These issues include but are not limited to:

a) Discussions of significant potential biases that can be identified in the application of an LI estimation method to DR activities such that methods for avoiding that bias can be developed.
b) Discussions of how the accuracy of LI estimates should be represented for the different estimation methods contained in the straw proposals. From a portfolio perspective, it could be argued that those DR activities that account for the majority of the load reductions should be estimated with greater precision. Sizeable error bounds around DR activities that are expected to only produce relatively small load reductions may not affect the resource contribution of the DR portfolio to any great degree.
c) Staff is of the opinion that DR activity and portfolio accuracy representations are likely to be needed for use in the cost-effectiveness assessments. Some issues to be addressed in the straw proposal might include:
    i. How should these representations be developed if different estimation methods are used for different DR activities?

ii. Are assumptions required about the correlation of errors in the estimates, or is it appropriate to assume that the error distributions (sampling distributions if statistically-based samples are used) are all uncorrelated?

iii. If there are common drivers in program estimates that would cause errors across different DR activities to be consistently over or under estimated, how will these be represented in developing representations of accuracy for the portfolio?

d) For DR activities where LI estimates are made at the customer level, i.e., a load reduction estimate is generated for each customer participating in the program, then how should the uncertainties in these individual estimates be aggregated up to get DR activity-wide/program-wide representation of accuracy?

e) Does the need for accuracy depend upon the application? For example, gaining high accuracy levels in geographic areas likely to be resource constrained due to transmission or distribution congestion may have a higher value than load reductions in other areas. Does DR for system operations have requirements such that the value of accuracy in the estimates of load reductions might vary depending upon application, e.g., spinning reserves versus system reserves? This may need to be addressed with input from the CAISO as the straw proposals are prepared.

f) Overall, how important is this representation of program and portfolio accuracy compared to uncertainties in supply-side resources, particularly the costs of producing a MW given uncertain fuel prices and uncertainties in environmental compliance (e.g., carbon scenarios) on the supply-side?

g) Since DR activities are rolled out incrementally across a number of years, it is possible to develop confidence in the estimates by tracking results over time. This experience-based approach is similar to what is used on the supply-side to assess forced outage rates for different types of generation, and to assess other risk factors such as combustion turbines that do not start up when called. Information on these factors is produced over time as experience is gained with these resources. Can this experience-based approach be viewed as viable on its own or in conjunction with other methods?

h) Given items (f) and (g) above, are rough representations of accuracy that are updated annually and incorporate a combination of judgment and statistics, M&V, and measurement good enough? What provides equivalent "trust" in DR resources, as in

supply resources, for their intended purposes (as used in D.05-11-009, p.11)? While a somewhat philosophical question, views on the role of information and experience with DR activities gained over time might be important as the industry is working to determine how to best incorporate DR into forward-looking resource plans and assess equivalence to other resource options.

4.9 Persistence of DR Load Impacts

Estimates of the useful life of DR assets and estimates of the persistence of impacts likely will be an input into CE assessments of DR activities. Staff sees this as an item that needs to be addressed, but is not a priority item for these LI straw proposals. Comments on the usefulness of general approaches, such as the experience-based approach as discussed in item (g) above, might suffice. The expected life of a generation unit, changes in unit performance over time, and related issues with other industry infrastructure (e.g., transmission system, pipeline capacity and availability for natural gas delivery, and distribution) are often determined over time from experience with these assets and comparisons with other systems (e.g., use of NERC data).

4.10 Relationship of LI estimates and Methods for CAISO Needs

The CAISO expressed the opinion that geographic resolution in load reduction capabilities from DR activities is important. It is not clear if this geographic resolution is similar to the separate estimation of impacts by climate zone. The California Statewide Pricing Pilot used four climate zones, while 16 climate zones are used for energy efficiency impacts in the CEC's Title 24 analyses. Climate zones may be important to take into account for estimating the load impacts of weather sensitive DR activities, but these zones may not correlate well with the geographic regions of interest to the CAISO, which may focus on load pockets and areas of congestion. There are several issues related to the ability to use LI estimates to help meet CAISO planning needs that should be considered in the preparation of the straw proposal. These include:

- Getting input from the CAISO on the geographic resolution of DR load impacts that would be most useful from their perspective.
- Gaining insight from the CAISO on what types of estimation processes would best facilitate the participation of DR in CAISO markets.

To the extent possible, staff hopes that the authors of the straw proposals are able to obtain input from the CAISO on the straw proposals that address these issues such that they can be incorporated in the discussions from the outset.

4.11 LI Estimation Straw Proposal – Organizational Guidance

A common organizing theme for the LI straw proposals could be by DR activity/program category and the LI estimation methods that fit that DR activity/program type. For each DR type, there will likely be several acceptable approaches that can be used for estimating its load impacts. The preferred approaches selected in the straw proposal are likely to depend on the data available, importance of the program in providing value in the portfolio, and the duration of the program, i.e., is it just starting up or does it have two, three or more years of history?

The authors of the straw proposals should organize the proposals in a way that best communicates their approaches. However, staff suggests that one organizing concept that should be considered is to develop categories of DR that can be mapped to different estimation methods. There would then be a second layer discussion on issues in estimation that, for example, might include:

- Basic data requirements for each estimation method.
- Role of customer specific data, i.e., can customers' load shapes and the day-to-day variability in load explain variability in load impact estimates and accuracy levels?
- Assessing rigor – bias, accuracy, and uncertainty:
    - At the DR activity/program level;
    - At the portfolio level; and
    - By geographic area, if that is important for benefits.
- Persistence of impacts and estimated useful life for DR assets in terms of ongoing activities.
- Geographic resolution needed to provide impacts in load pockets and congested areas for appropriate valuation and use by the CAISO and utilities in planning.
    - Capacity constraints;
    - Transmission congestion; and
    - Distribution avoided investment.

A possible outline following this concept might be:

1. Purpose and Applicability of LI Estimation Protocol
    - 1.1 Relationship to Other Proceedings
    - 1.2 Uses of Estimated Load Impacts in Cost-Effectiveness Analyses – How will the information be used in CE assessments?
    - 1.3 Relationship to CAISO needs and MRTU
2. Discussion of Impact Estimation Methods
    - 2.1 Links to EE Evaluation Protocols and Other DR Impact Work
    - 2.2 Specific Methods That May Be Used (each should address the following issues)
        - 2.2.1 Load data requirements for each method
        - 2.2.2 Use of customer load shape data to explain variations in LI estimates and to improve estimates
        - 2.2.3 Assessing rigor – bias, accuracy, and uncertainty
        - 2.2.4 Persistence of DR load impacts
3. DR Activities to be Addressed in Straw Proposals – Emphasis on the DR Portfolio including Pricing Options
    - 3.1 Taxonomy of DR Activities – Categorization
    - 3.2 Estimation Methods Appropriate to DR Program Type
        - 3.2.1 Required data – sample, sub-sample, population
        - 3.2.2 Resolution – geographic to assess values by location
        - 3.2.3 Resolution – load response by notification time
        - 3.2.4 Impacts of weather on impacts – extreme temperature days
        - 3.2.5 Impacts of customer load characteristics on LI estimates and accuracy
4. Additional Discussion as Necessary

5. Staff Guidance for Straw Proposals on Cost-Effectiveness Methods for DR

The straw proposals are meant to focus on development of one or more methodologies for determining the cost-effectiveness of DR activities. Staff is aware of the effort required to develop straw proposals on both LI impact estimation and on CE methods. As a result, it is appropriate to develop the objectives of the straw proposals on CE methods in a context that is consistent with the OIR and ACR. The OIR references D.05-11-009 as recognizing the need for additional work to integrate DR activities into the resource planning process (OIR, p.3) and that is viewed as the appropriate focus for the development of CE frameworks, i.e., frameworks that

allow for DR activities to be compared to other alternatives in developing a forward-looking resource plan (See Section 3.3 above).

A discussion of the relationship of this rulemaking to other on-going proceedings is presented in Section 2.2. Also, Section 3 presents some general guidance that applies to both straw proposals, i.e., to both the LI Estimation straw proposal and the CE Methods straw proposal. In particular, these general guidelines call for both non-event and event-based DR to be addressed including CE methods for DR pricing activities (see Section 3.2 above).

5.1 Context and Goals for the CE Methods Straw Proposals

The goal of the CE methods development in the straw proposals is to make progress in defining appropriate CE frameworks that are able to consider the factors viewed as material for assessing the CE of DR activities. There is recognition that this could become a significant undertaking and that the CE methods, if developed in detail and final form, would extend beyond the intended scope of this rulemaking. Instead, the methods should build on existing work where practical, improve currently applied methods, with an expectation that some processes contained in the proposed CE methods within overall CE frameworks may be viewed as interim. While some of the processes may be viewed as interim and may be refined or reassessed in the future, expectations for the straw proposals on CE frameworks include:

1. A listing of material factors and attributes of DR activities that a comprehensive CE framework should be able to address. To the extent practicable, "the results of this task should address the broad variety of DR approaches, including current and anticipated future activities" (ACR, p.7).
2. The straw proposals should develop frameworks that can address the identified material factors from item 1 (above), which can be used in upcoming DR assessments and applications, with the knowledge that future work may continue to address and refine important components of these frameworks.
3. As complete a list as possible of relevant quantitative and qualitative inputs (other than load impacts) that are important for determining cost-effectiveness of DR.
4. The CE method straw proposals "should recommend values for the inputs, or at least recommend methodologies for determining the value of the inputs. If further work is needed to develop satisfactory inputs, the Commission may consider relying on

interim values or methodologies (e.g., estimates used in other proceedings) until additional work can be undertaken" (ACR, p.7). In some cases, the practical solution may be to use ranges for the values of some inputs, or the proposal of a research agenda needed to produce values.

5. As was the case with the LI estimation impact methods, the ACR recognizes that the broad variety of DR approaches, including current and anticipated future activities, may require that there be different CE methodologies that are appropriate for different types of DR activities.

Overall, the goal is to improve the CE processes used for DR assessment without setting objectives that are beyond the reach of this rulemaking, given its scope and timeline. The context for the CE methods straw proposals will be further defined in the subsections below.

Avoided Capacity and Energy Costs – Context

This Guidance Document suggests only the basis of an interim avoided cost methodology for use in these straw proposals in Section 5.4 (below) in order to avoid the contentious and time-consuming litigation likely to follow if parties are asked to develop more detailed methods for avoided cost calculation in the straw proposals. This suggested interim methodology is intended to act as a placeholder, to enable an overall CE framework to be developed through this proceeding, and to move the process forward until there is an appropriate time and venue to develop an avoided cost methodology.

Decision 05-11-009 states that avoided costs are not meant to be a focus of this rulemaking: "The issue of developing an avoided cost methodology is separate from developing the cost-effectiveness tests themselves."(p.13) However, avoided costs are necessary inputs to any CE assessment. As a result, two recent avoided cost approaches submitted in other proceedings are cited in Section 5.4 (footnotes 31 and 32). The expectation is that that the authors of the straw proposals can work with the basic components of these avoided cost methods. It is hoped that the straw proposals will work with avoided costs at a high level of construct, i.e., addressing the most material aspects of avoided costs as they related to CE assessments. With this focus, the straw proposals may decide that the use of a range of avoided cost values can be used as interim inputs to CE assessments. This would allow for the robustness of the CE assessments to be examined.

5.2 Links to Prior Benefit-Cost Tests and CE Assessments

Staff does not have a position on the CE frameworks and the benefit-cost tests consistent with that framework that should be contained in the straw proposals. The OIR and ACR provides similar flexibility to consider new approaches, but there is an interest in seeing if refinements to the SPM might improve the CE assessment of DR activities. The OIR states that:

> *"The California Standard Practice Manual (SPM), which was derived as a cost-effectiveness protocol for energy efficiency programs, appears to be a valid starting point for designing a suitable cost-effectiveness methodology for DR programs. The SPM provides a variety of tools for developing cost-effectiveness methodologies for DR programs as well as identifying cost and benefit components. We encourage stakeholders to provide meaningful input on how to best refine the SPM so that it can more accurately reflect the value of DR programs."* (OIR, p.7)

The ACR does not specifically reference the SPM as a starting point and leaves the issue up to the authors of the CE straw proposals whether DR CE methods might be best served by tests and procedures that may be based on CE frameworks that differ from those used in or that underlie the SPM tests. This measured and open approach to establishing CE frameworks in the straw proposals is also contained in D.05-11-009 where it states:

> *"The time has come that we should begin a process to adapt the SPM tests to the unique features of demand response programs* ***OR*** *develop alternative tests for assessing cost-effectiveness."* (Decision, p.13, emphasis added)

The statement that a process should begin supports the concept that aspects of the CE frameworks contained in the CE straw proposals are meant to improve on the methods currently used, even if some input values or methodologies are interim (See ACR, p.7). Given the historical role of the SPM tests, straw proposals that develop other test frameworks should compare these tests to the SPM framework in terms of advantages and disadvantages.

Staff does not take a position on whether the most appropriate path involves the refinement of the SPM or the development of alternative tests. This issue is left to the authors of the straw proposals, allowing for the development of CE frameworks and tests deemed most appropriate for DR. However, each straw proposal should clearly state the pros and cons of the tests and CE framework(s) that are proposed.

As an observation, the use of smooth year-to-year increases in forecasts of demand, fuel prices, and other system inputs (e.g., at a constant rate of inflation) will likely under-value DR.

One of the benefits of DR is its flexibility and granularity over time and across geography to mitigate year-to-year, season-to-season, and even day-to-day and hourly volatility in peak loads, performance of generation, short term supply-demand imbalances, transmission outages, and other system stress events.

The SPM, as it has been applied to energy efficiency activities, has not traditionally incorporated real-world volatility and uncertainty into its tests. This might be more important for CE frameworks addressing DR activities and may be an area where refinements to the standard application of the SPM might be beneficial.

The selection of the proposed CE framework(s) is left to the authors of the straw proposals. While staff does not advocate any approaches for discussion or inclusion in the straw proposals, an example alternative approach is offered as a potential illustration. The differential revenue requirements (DRR) approach[27] has been used and still is being used in resource planning and in the analyses of DR and EE activities in other jurisdictions. The DRR approach examines the cost-effectiveness of a resource by examining the revenue requirement of two resource plans – one plan without the resource included in the plan and a second plan that includes the resource.

The benefit-cost test that underlies this approach is based on reducing revenue requirements by an amount that is less than the cost of the alternative resource. Reductions in system costs and investments can be compared to the costs of the alternative resource (i.e., the costs of DR) to produce a benefit-cost ratio. As is the case with the SPM, a present value of net benefits representing absolute savings can be calculated. This approach focuses on minimizing the overall resource investment needed to meet all future years' electricity demands, holding reliability constant.

For DR, the regional electric system would be modeled using a capacity/production cost model with a specified amount of DR and then modeled without the DR. The differential in revenue requirements between the with and without DR scenarios provides an estimate of the value of DR. A possible benefit from using a structural model approach rather than time-series forecasts of market prices to assess the benefits of DR is the types of sensitivity analyses that can

[27] It is also described in "I*nventory of Available Methods and Processes for Assessing the Benefits, Costs, and Impacts of Demand-Side Options: Volume 1 — Overview of Methods Models and Techniques,*" prepared for the IEA DSM Programme, By EPRI and SRC International, 1996.

be performed. Probability distributions (or scenarios) can be developed for model inputs that are tied to structural factors that influence electricity availability and prices. In this context, resource plans (with and without DR) can be examined across these different scenarios[28] to determine the ability of DR to mitigate a number of risks. These could include those that may be associated with higher than expected growth in fuel prices, higher than expected fuel price volatility, plant outages, faster than expected growth in peak demand, delays in bringing capacity online when needed, and delays in expanding transmission load-carrying capabilities when needed.

5.3 Identifying Material Factors for the CE Framework

The way the SPM is conventionally applied may not capture the dynamic attributes of DR activities in terms of their flexibility and granularity. DR provides an opportunity to target and mitigate the highest electricity costs during a season, year, and even across years in a long-term resource planning. The flexibility and granularity of DR can allow it to serve as an option that can hedge against adverse market conditions. These may include:

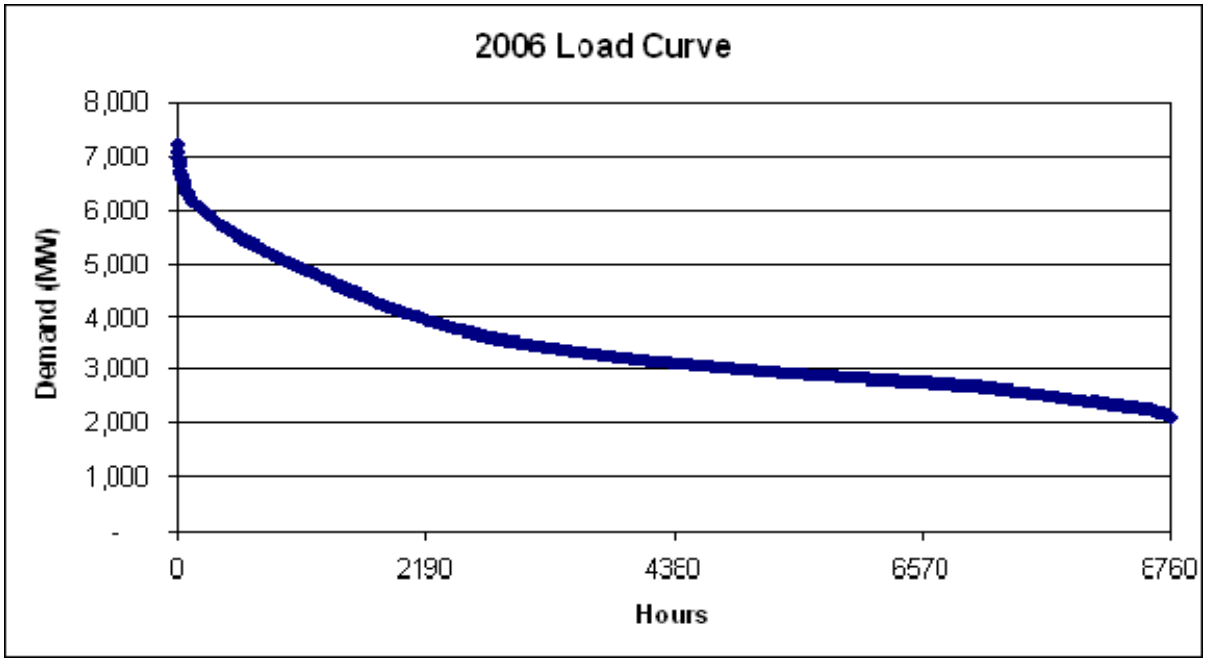
- A period of high fuel prices used to generate electricity. This could be a single summer of high prices, price spikes that may last weeks, or a higher than expected growth rate in these input fuel prices.
- Capacity shortages can not be predicted. Even though there has been adequate capacity in recent years, conditions a few years into the future may be different. It takes time and capital to build generation and the electric industry has many of the characteristics of a commodity-based, capital intensive industry that can lead to over- or under-building scenarios in generation or in supporting infrastructure.
- Some CE methods are predicated on an assumption of market equilibrium in the future where supply will match demand affording generation investments at the required market return and a predictable cost of new entry. It can be argued that market disequilibrium, particularly on a locational basis, has been as common as a workably competitive market in equilibrium. Even a few years of capacity shortages that cover only a few hours each year can be quite expensive.

[28] In the extreme, Monte Carlo processes can be used to directly incorporate distributions of outcomes and produce calculated values of real options provided by the flexibility and granularity of DR activities.

- During times of high demand, the number of suppliers available to provide the needed incremental electricity declines, and this can result in an increase in the market pricing power during high demand periods. Increasing the price-elasticity of demand where customers have an option to use less energy during periods of high cost power may curb market power. This could result in the avoidance of price spikes and lower electricity prices to all customers both in the short term and in the longer term, as flexible demand serves as a hedge against high prices.
- The uncertainty in the future costs of producing electricity from the traditional supply-side options is growing with volatile input fuel prices and uncertain environmental compliance costs. Given that DR activities as defined in the ACR (p.6) do not use a fossil fuel as an input, DR might be able to meet future peak demands with greater certainty in the cost of providing that peaking capability.
- Demand response can make the electric market more efficient by providing customers with the ability to adjust their electricity use when the costs of electricity are high.

One premise in the DR value proposition is that a only a few hours (around 100 hours or approximately 1.1% of the hours) can contribute a disproportionate amount to the peak demand (See Figure 1).

Figure 1: Load Duration Curve for a Western Utility



Whether these few hours of high demand translate into high electricity prices will depend on the amount of generation capacity available to meet that demand. If adequate capacity is available, the price increase that results from increasing supply to meet peak period demands may not be very high.[29] However, in times when capacity is constrained, a small decrease in demand in these top 100 hours might reduce electricity costs substantially. One factor that can influence the value of DR is the likelihood that there will be market disequilibria in the future,[30] even if only for a few years and possibly only for a few months (and hours in those months).

This poses one of the DR cost-effectiveness framework conundrums: How do you estimate the likelihood that there will be an adverse electricity market event in the future? These events tend to be difficult to predict in terms of the likely number of events and their severity. However, it is nearly certain that these events will happen in the future. As a result, some DR resources are used to their full capacity infrequently but, when used, they provide a high value in terms of mitigating high electricity costs. This dynamic aspect of DR can be hard to value.

There are two ways DR can address this issue. First, it can change the rate of increase in the peak demand and flatten out the load curve so that the market costs are not so sensitive to small changes in demand. Pricing options such as TOU, CPP, and RTP designs can reduce growth peak demands by both reducing load and shift load from peak hours to off-peak hours. This can reduce the overall need for peaking resources and the costs associated with building those resources. Second, demand response activities can be used to serve those high cost 100 hours that comprise the peak of the load duration curve.

The ability of a cost-effectiveness framework to address these dynamic aspects of DR and increased portfolio diversity may be important.

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[29] A normal supply demand relationship can produce prices that increase by 100% from peak to off-peak periods. While this may seem like a large increase in electricity costs, electricity costs are very time dependent and are among the most volatile of any commodity product. In periods of tight capacity, a 500% increase or more has been seen in electricity markets.

[30] This may be due to unexpected outages at generation plants that last for an extended period of time, or transmission constraints where there is adequate generation, but not enough transmission line capacity available on the highest demand days (often the hottest days of the summer which reduces line transfer capability) to get the generation to select load centers.

5.4 Avoided Capacity and Energy Avoided Costs as DR Benefits

As discussed in Section 5.1, this proceeding is not meant to focus on methods for calculating avoided costs. However, California utilities have developed estimates of avoided costs in several recent Applications to the CPUC. For the purposes of this rulemaking only, it is proposed that the avoided cost framework from two recent Applications form the basis for interim avoided cost estimation. To allow this rulemaking to focus on the overall CE Framework and other needed inputs, it is proposed that the methods used in these Applications – one by SDG&E in an application for AMI deployment,[31] and one by PG&E, as part of an application for an air conditioning (AC) direct load control (DLC) program[32] – be used as the interim method for estimating avoided costs. The methods used in each filing employ certain similar concepts:

1. They each use a combustion turbine to derive the avoided capacity costs using a combustion turbine as the assumed marginal unit; and,
2. They each develop an avoided energy cost based on market prices.[33]

While these two filings have certain similar elements, there are differences in the specific way in which the avoided capacity and energy costs are calculated. As a result, they will produce somewhat different estimates of avoided costs. This may result in a range of avoided costs being appropriate for interim CE frameworks. However, using the avoided cost approaches from these two filings should help facilitate one of the objectives of this rulemaking, i.e., a focus on the overall CE framework rather than on a debate over the calculation of avoided costs. This latter issue is outside the scope of this proceeding.

5.5 Other DR Benefits

Other DR benefits that might be considered in the straw proposals include indirect or market effects. A list is provided below, but this should not be construed to be comprehensive.

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[31] Application of San Diego Gas & Electric Company (U-092-E) for Adoption of an Advanced Metering Infrastructure Deployment Scenario and Associated Cost Recovery and Rate Design – Chapter 7: Capacity and Energy Values of AMI-Enabled Demand Response, John C. Martin, July 14, 2006. The benefits of reduced system peak for Transmission and Distribution are found in Chapter 4 authored by Mr. Lee of SDG&E.

[32] Application of Pacific Gas and Electric Company 07-02-__(U 39 E) for Approval of Demand Response Agreements -- Prepared Testimony, February 28, 2007.

[33] The SDG&E approach calculates the avoided energy cost using a multi-area production cost model. PG&E selected estimated market prices for the 100 hours with the highest loss of load probability. The difference in avoided costs resulting from these two methods has not been calculated. However, the processes used in each approach appear reasonable as interim methods, which can produce interim avoided cost estimates. One other difference is that SDG&E produced avoided T&D costs, while PG&E did not consider avoided T&D costs as a benefit of its AC DLC program.

The authors of the straw proposals are expected to develop categories of benefits that they believe would meet the ACR goal of identifying "relevant quantitative and qualitative inputs (other than load impacts) that are important for determining cost-effectiveness of DR" (p.7). Examples of benefits that staff believe are worthy of consideration are presented below and include:[34]

1. Reduced market power by allowing demand to adjust in response to higher prices. Increasing the price elasticity of demand decreases market power.
2. Lowered market prices for all customers, not just DR participants.
3. Lowered long-term trend in rising electricity costs.
4. Appropriate technology and behavioral incentives for development of methods to reduce peak loads and shift peak loads to off-peak periods.
5. Portfolio benefits of an expanded set of options for meeting peak and high-cost loads (can impact reliability).
6. Hedge values due to mitigating the impacts of adverse energy market outcomes.
7. Ability to locationally target DR to address geographic market constraints in capacity and/or transmission.
8. Modular nature of DR in that it is built up in increments over a period of time, and can be maintained when there is adequate capacity, i.e., no new customers are added.
9. For customers, DR can provide them with options for better managing their electric bills, either through time-differentiated/dynamic pricing or by participating in a curtailable load program.
10. Environmental benefits in terms of reduced emissions, land use and water use. This also reduces the risks associated with uncertain environmental compliance costs in the future.

These attributes of DR are difficult to value within a static benefit-cost framework and may require some simulation modeling and stress-case scenario analyses.

Staff recognizes that industry standard approaches do not exist for valuing many of the DR benefits listed above and encourages straw proposals to develop interim approaches that might be useful for dimensioning these DR benefits.

[34] A Demand Response Cost-Effectiveness Scoping Workshop was held on March 21, 2006. The listing of benefits developed at that workshop contributed to the list included in this document, with some care to exclude benefits that appeared potentially double count the same effects.

5.6 Cost-Side of the CE Assessment

Decision (D.) 05-11-009 called for the tracking of "program capital and operating costs, and incremental customer costs, including comfort changes or customer costs during curtailments."(p.12) As a result, the straw proposal should assess processes for collecting/estimating program costs to the utility or program administrator. In addition, there is a need to develop incremental costs to customers, both participants and non-participants. These may be:

- Treatment of customer costs related to comfort and use value of foregone electricity use.
- Estimation of lost (or increased) production and business costs due to different types of DR.

There are no known recent studies of the value of foregone electricity use during curtailments or control events. This is an area where the straw proposals may need to develop a research agenda that would provide estimates of these values over time, possibly integrated with the delivery of DR activities to customers, while still trying to produce order of magnitude interim values.

The ACR calls for the identification of "relevant quantitative and qualitative inputs (other than load impacts) that are important for determining cost-effectiveness of DR." This applies to both costs and benefits.

Cost categories that were raised at a Workshop on DR Cost-Effectiveness, March 21, 2006 included program costs incurred by the utility or program administrator and costs to customers. Some costs that the straw proposals might want to consider for inclusions in the CE framework include:

PROGRAM COSTS

- Program planning costs
- Marketing and market research costs
- Implementation costs
  - Any field costs associated with equipment installation, e.g., smart thermostats, switches, energy management systems, customer on-premise communications (e.g., wireless devices)
  - Communications costs, if signals are sent to customers

  - Customer education
  - Incentives
  - Evaluation and M&V costs
  - On-going program maintenance (e.g., dealing with participant turn-over)
  - Administrative costs
    - Customer billing and settlements
    - Customer service (e.g., call center costs)
    - Management (e.g., vendor compliance and information systems)
- Lost revenues
- Costs of providing increased power during hours where load may increase due to shifting or technology-driven snapback
- Other program costs

CUSTOMER COSTS

- Participation costs (e.g., time to participate, hassle costs, other transaction costs)
- Incremental costs of equipment needed to participate (if paid for by the customer)
- Value of lost service (i.e., in event-based DR activities)
- Net lost value of shifted load (e.g., changes in comfort, and the net change in value of use from shifted usage patterns)
- Reduced production or productivity for business customers
- Increased payments for electricity in hours where use is increased

The list of costs shown above is not meant to be comprehensive but is illustrative of potential cost categories that were raised at the March 21, 2006 workshop on DR cost-effectiveness.

5.7 Role of Ex Ante and Ex Post Cost-Effectiveness Analyses

As was the case with load impacts, cost-effectiveness assessments can be ex ante (i.e., forward looking) or ex post (i.e., retrospective). Ex post assessments look back at the benefits and costs of a DR activity over a specific period of time for which historical data are available. Ex post analyses are important to ensure that the projections of DR benefits and costs were accurate, determine if there are benefits and costs that were unaccounted for at the time of DR activity planning, and for use in updating forward projections of benefits and costs for that DR activity.

However, consistent with the focus on integrating DR into resource planning, the focus of the cost-effectiveness framework in the straw proposals should be on ex ante, or forward-looking planning assessments that balance the benefits and costs of DR activities, both individually and in a DR portfolio, with other resource investments. In an ex post or retrospective assessment, many factors are known such as weather, actual peak loads, actual locational loads, actual generation produced, plant outages or transmission constraints. An ex ante or forward-looking planning assessment likely will require projections of these factors. In addition, these studies may need to apply planning criteria such as 1-in-10 year or 1-in-20 year events (weather, load or system failures) as appropriate for and consistent with resource planning.

In summary, the straw proposals should focus on forward looking frameworks that try to meet one of the objectives recognized in D.05-11-009, i.e., the need for additional work to integrate DR activities into the resource planning process (OIR, p.3). Staff does not want to prejudge the approaches that will be developed in the straw proposals.

5.8 Implications of the CAISO's MRTU

The CAISO plans are likely to have some impact on the benefits and costs of DR activities, with different impacts on different program types. Staff hopes that the authors of the straw proposals are able to obtain input and advice from the CAISO such that the impact of MRTU is addressed in the CE methods contained in the proposals. DR resources should be efficiently incorporated in the CAISO's wholesale markets. This would include day-ahead market of its MRTU during the first quarter of 2008, which could affect or be affected by DR efforts. There has also been a concern expressed that the CAISO needs to account for existing demand response in a way that does not promote procurement of redundant supply-side resources.

"Identifying where there are disconnects or gaps between existing retail DR programs and the CAISO's operational needs for the wholesale market, both currently and when MRTU is implemented," (OIR, p.8) will be a factor in the cost-effectiveness of DR activities. Given the potential interactions between the value of DR activities and CAISO wholesale markets and operations, CE frameworks contained in the straw proposals should, to the extent practical, account for the impact of the MRTU on cost-effectiveness assessments of DR activities.

Similarly, it is hoped that the CAISO will work to take full advantage of the attributes of DR activities in its market designs and operations.

5.9 Addressing Uncertainty in Cost-Effectiveness Estimates

Addressing uncertainty and representing uncertainty in CE estimates can pose a challenge. One DR resource may have a high expected benefit-cost ratio, but it is dependent upon a number of factors that may be uncertain. Different approaches are available such as scenario analyses, but increased usability of Monte Carlo approaches opens up new options.

Assessing rigor poses the same problem here as it does for load impact estimates. Many of the inputs to any CE method are subject to uncertainty, particularly forecasts into the future. As a result, any CE method should address the potential for bias and how uncertainty should be represented.

Uncertainty in the value and contribution of DR activities should be placed in context with uncertainties in the costs and performance of other resources ranging from renewables to fossil fuel plants. For example, it is unlikely that fuel prices will increase at a constant inflation rate each year. Instead, there are likely to be years when fuel prices jump (as they have in the past) and possibly decline somewhat in a subsequent year. In addition, fuel prices, plant performance, transmission system performance are likely to vary by year and by season. DR provides a hedge against volatility in any of these electric market factors. As a result, it is important that CE frameworks incorporate forecasts that represent real-world volatilities that could translate into periods of high prices if DR were not available to mitigate these adverse market situations to some degree.

5.10 Organization of Straw Proposal on CE Methodologies

The framework of CE methods may tend to be self-organizing in that approaches to benefits are first considered, usually from most certain and easiest to estimate, to least certain and most difficult to estimate. The same is true for the cost side.

Staff hopes that an initial framework can be developed that addresses some of the issues raised in previous CPUC proceedings. As stated in the ACR, “the Commission may consider relying on interim values or methodologies (e.g., estimates used in other proceedings) until

additional work can be undertaken" (p.7). The straw proposals should address the further work that is needed to improve on these interim estimates.

The ultimate organization of the straw proposals on CE methodologies for DR activities should be determined by the authors of the proposals based on what they believe is the most effective approach to communicating their proposed methods.