

# CONSISTENT EVALUATION PROTOCOL (CEP) FOR ENERGY STORAGE BENCHMARKING AND GENERAL REPORTING PURPOSES

February 28, 2014; Revised December 1, 2014

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# CONSISTENT EVALUATION PROTOCOL (CEP) FOR ENERGY STORAGE BENCHMARKING AND GENERAL REPORTING PURPOSES

## A. Background and Scope

### 1. Background

The Decision Adopting Energy Storage Procurement Framework and Design Program (“the Decision”) requires the Investor Owned Utilities (“IOUs”) to confer with Energy Division Staff to develop a consistent evaluation protocol to be used for benchmarking and general reporting purposes.<sup>1</sup> Accordingly, Pacific Gas & Electric, San Diego Gas & Electric, and Southern California Edison worked with the Energy Division to create this “Consistent Evaluation Protocol” (“CEP”) document.

In Appendix A of the Decision, Section (3)(d), the CEP is described further as the following.

*“An evaluation protocol consistent across the IOUs that includes a consistent set of assumptions and methods for valuing storage benefits, such as market services and avoided costs, and estimating project costs that allow adjustments for utility-specific factors (such as location, portfolio, cost of capital, etc.) and utility-specific modeling tools based outputs affecting valuation as appropriate to provide a consistent basis for comparison across utilities, bids, and use cases.”*

The CEP includes both quantitative and qualitative information. The CEP is not meant to directly correlate to IOU specific evaluation or shortlisting criteria. Therefore, the outcome under the CEP will differ from the outcome under the IOU specific evaluation protocol.

### 2. Scope

Nothing in the CEP is to be construed or implied as restricting or invalidating the assumptions, models, tools, and analysis each IOU might choose to value, rank, or shortlist the physical and financial merits of offers or bids from the IOUs’ energy storage solicitations (Offers) that might be received to comply and fulfill each IOU’s energy storage needs at the transmission, distribution, and customer levels.

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<sup>1</sup> D.13-10-040, at 63.

As stated in the Decision, the CEP is only for “benchmarking and general reporting purposes” and is not a replacement for the IOUs’ individual, proprietary, evaluation protocols to be used to evaluate the cost and benefits or other quantitative or qualitative aspects of Offers resulting from IOU energy storage solicitations.

The CEP is focused on the methodology to determine Net Market Value (NMV). For the CEP to yield consistent numerical results across the IOUs for reporting purposes, publicly available information will be used as a substitute for the confidential, commercially-sensitive inputs the IOUs will use in evaluation of actual commercial Offers from market participants.

Beyond NMV, each IOU will have specific qualitative and quantitative elements that will be used to evaluate and select energy storage projects. Those IOU-specific qualitative and quantitative elements are not included in the CEP and will not be limited by the CEP. The Decision clarifies this intent as follows.

*“We agree with parties that any actual finding of cost-effectiveness should only be done in a utility application for approval of storage contracts or rate-based additions, where there is a specific project and actual project inputs... As such, we **shall allow the IOUs to propose their own methodology to evaluate the cost and benefits of bids.**[emphasis added]”*

The CEP shall not be implemented into a model. To complete the CPUC’s benchmarking and reporting goals, each IOU will evaluate the quantitative and qualitative elements of short-listed energy storage projects through its respective models, albeit using publicly available input assumptions needed to calculate NMV.<sup>2</sup> Given that the purpose of the CEP is to provide a succinct comparison tool for storage Offers, it is not possible to capture every cost and benefit of storage Offers in the CEP. The scope of the CEP includes all three of the storage domains defined in the Decision—transmission, distribution and customer—in either a quantitative or qualitative form.

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<sup>2</sup> Described in Section C below.

## **B. Presentation Format for CEP and Confidentiality**

### **1. Presentation Format for CEP**

The presentation format for Offers under the CEP will be an electronic spreadsheet, an example of which is included as Attachment 1 of this document (the Spreadsheet).<sup>3</sup> The Spreadsheet will include prescribed column headings for information describing the Offers. Per the Decision, this information will be based on a, “consistent set of assumptions and methods for valuing storage benefits” as described herein. For each of the Offers, the Spreadsheet will include:

- **Descriptive information** about the Offers and their proposed projects, as described in Section D below.
- **Quantitative information** consisting of an NMV calculation, inputs to NMV, and the benefit and cost components used to calculate NMV, as described in section Section E below.
- **Qualitative information** consisting of an indication of which energy storage ‘end uses’<sup>4</sup> might exist for each of the Offers, as described in section Section F below.

The Spreadsheet will not include all evaluation rating or ranking elements or criteria that may be considered in utilities’ evaluations of Offers. For example, the Spreadsheet does not capture information on (1) Location, (2) Portfolio Need, (3) Contract Length, (4) Project Viability, (5) Supplier Diversity, (6) Credit Status including Counterparty Concentration, (7) Number of Proposed Modifications to the Power Purchase Agreement (“PPA”) and (8) the Offer’s consistency with and contribution to California’s goals for the energy storage program.

### **2. Confidentiality**

Information provided to the California Public Utilities Commission (“the Commission”) via its staff is confidential under California Public Utilities Code Section 583 and confidentiality requirements contained in D.06-06-066 and D.13-10-040. However, such information may be shared with the

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<sup>3</sup> This document and its attached spreadsheet constitute the CEP in its entirety.

<sup>4</sup> As identified in the Decision Adopting Proposed Framework for Analyzing Energy Storage Needs (D.12-08-016), August 6, 2012, at 23.

California Independent System Operator (“CAISO”), each IOU’s Procurement Review Group (“PRG”), or any other regulatory agencies under the appropriate confidentiality protection, without destroying the confidentiality protection afforded by the Commission.

### C. Standardized Planning Assumptions

The calculation of NMV requires assumptions for several inputs, including, but not limited to,

- Forecast hourly energy prices,
- Forecast capacity prices,
- Forecast ancillary services value,<sup>5</sup>
- Forecast monthly natural gas prices,
- Discount rate,
- System loss factors, and
- Forecast greenhouse gas (GHG) costs.

For any calculations under CEP, publicly available information will be used. One of the Commission’s consultants, Energy and Environmental Economics (E3)<sup>6</sup> produced an avoided cost calculator, which provides some public information. This avoided cost calculator includes a publicly available forecast of natural gas prices using the 2011 Market Price Referent (MPR) methodology and a public forecast of GHG prices using the 2009 MPR methodology.<sup>7</sup> In addition, E3’s avoided cost calculator also includes public price forecasts for energy and capacity, system loss factors for each IOU, and discount rates for each IOU.<sup>8</sup> The most recent avoided cost calculator is named “DERAvoidedCostModel\_v3.9\_2011 v4d.xlsm” and is available on E3’s

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<sup>5</sup> In the absence of a publicly available forecast of ancillary services prices, the CEP will use surrogate prices for ancillary services based on agreed upon monthly percentages of energy prices.

<sup>6</sup> For background, note that E3 also produced the Commission’s Market Price Referent (MPR) model.

<sup>7</sup> The MPR models are available at [http://www.ethree.com/public\\_projects/cpuc3.php](http://www.ethree.com/public_projects/cpuc3.php)

<sup>8</sup> E3’s describes the source of inputs—e.g., discount rate, system losses and GHG costs—and calculation methodology of outputs—e.g., energy, capacity and natural gas prices—for the publicly available information in its avoided cost calculator in two documents at [http://www.ethree.com/public\\_projects/cpucdr.php](http://www.ethree.com/public_projects/cpucdr.php). The names of the two documents are: “Revised DG Cost Effectiveness Framework Avoided Cost Methodology Description” and “Avoided Cost Methodology Description”.

website.<sup>9</sup> The aforementioned information from E3's avoided cost calculator will be included in the CEP as input assumptions.

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<sup>9</sup> [http://www.ethree.com/public\\_projects/cpuc5.php](http://www.ethree.com/public_projects/cpuc5.php)

**D. Descriptive Information Included in the CEP Spreadsheet**

The CEP Spreadsheet will include descriptive information about the Offers as listed in Table 1.

**Table 1  
Descriptive Information Included in the CEP Spreadsheet**

<b>IOU</b> (PGE / SCE / SDGE)	<b>Commercial Operation Date</b>	<b>Self-discharge</b> in Stand-by (MW/hour)
<b>Name of Shortlisted Project</b>	<b>Term</b> (Years)	<b>Ramp rate</b> – charge/discharge, up/down (MW/hour)
<b>Interconnection Voltage</b> (kV)	<b>Max Capacity</b> – Charge/Discharge at grid connection point (MW)	<b>AGC</b> (yes/no)
<b>Interconnection Level</b> (Transmission / Distribution)	<b>Min Capacity</b> – Charge/Discharge at grid connection point (MW)	<b>Regulation at zero</b> -- up/down (yes/no)
<b>Local Capacity Area</b>	<b>Qualifying RA Capacity</b> (MW)	<b>Contract Cost</b> (\$)
<b>Zone</b> (NP / ZP / SP)	<b>Duration</b> of max sustainable discharge rate (Hours)	<b>Variable O&amp;M</b> for discharging (\$/MWh)
<b>Status</b> (New / Existing)	<b>Efficiency</b> at max capacity (%)	<b>Fixed O&amp;M</b> (\$/kW-year)
<b>Product</b> (Dispatchable / RA)	<b>Max daily switches</b> – charge/discharge (# charges per day)	
<b>Energy Storage Technology</b>	<b>Max cycles</b> per lifetime (# cycles)	

**E. Quantitative Information Included in the CEP Spreadsheet**

**1. Net Market Value Overview**

For the CEP, the Offers will be evaluated in terms of dollars per kilowatt (\$/kW). NMV is the net present value (NPV) of future benefits minus future costs for the projects resulting from the Offers. The benefits will include the items listed in Table 2, levelized in \$/kW. Costs will be defined as the direct and indirect, fixed and variable costs of a given project over its term. Costs will include the items listed in Table 2, levelized in \$/kW. The CEP Spreadsheet will include quantitative information about the Offers as listed in Table 2 below.

**Table 2**  
**Quantitative Information Included in the CEP Spreadsheet**

<b>Market Benefits</b> (Levelized \$/kW)	<b>Market Costs</b> (Levelized \$/kW)
Capacity / Resource Adequacy Value	Fixed Capacity Payments and Fixed O&M Cost
Energy Value	Charging Costs and Variable O&M Cost
Ancillary Services Value	Network Upgrade Cost (paid by CAISO consumers)
Distribution Investment Deferral Value (if applicable to project)	GHG Compliance Cost (if applicable to project)
	Debt Equivalency Cost
	Market Participation Costs

NMV is calculated for each Offer with the following formula based on publicly available information:

$$NMV = (C + E + AR + DD) - (F + V + N + GHG + DE + MPC)$$

Where:

C = Capacity / Resource Adequacy Value

E = Energy Value

AR = Ancillary Services Market Value

DD = Distribution Investment Deferral Value

F = Fixed Capacity Payments and Fixed O&M Cost

V = Charging Costs and Variable O&M Cost

N = Network Upgrade Cost

GHG = GHG Compliance Cost (if applicable to project)

DE = Debt Equivalency Cost

MPC = Market Participation Costs

## **2. Capacity / Resource Adequacy Value**

The value of capacity / resource adequacy (RA) associated with each Offer will be determined based on the projected monthly qualifying RA capacity and publicly available forecast capacity prices.

## **3. Energy Value**

The market value of energy deliveries is based on the hourly generation profile of each Offer considering operating characteristics and limitations, such as delivery date, delivery term and delivery location and operational constraints. The market value of the energy will be based on the publicly available forecast energy prices. The quantity of energy delivered will be an output of each IOU's dispatch modeling tool. System loss factors both at the transmission and distribution level depending on the interconnection will be used to incorporate losses specific for each IOU.

## **4. Ancillary Services Value**

Ancillary Services (AS) value will be assessed based on the ancillary service capability of each Offer. In the absence of a publicly available forecast of AS prices, the CEP will use surrogate prices for ancillary services based on agreed upon monthly percentages of hourly energy prices.<sup>10</sup> AS values will be determined by each IOU's dispatch modeling tool using the surrogate AS prices. An energy storage device can generally operate in either the AS market or the real time energy market but not both.

## **5. Distribution Investment Deferral Value**

For Offers that provide a distribution investment deferral value, as calculated by each IOU using its own criteria, the resultant value will be shown for benchmarking and reporting purposes.

## **6. Fixed Capacity Payments and Fixed O&M Cost**

The fixed payments for the project will be provided in the Offers.

## **7. Charging Costs and Variable O&M Cost**

Charging costs for energy storage includes the cost of electricity to charge the project. The source of Variable Operations and Maintenance (O&M), station

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<sup>10</sup> Before utilities submit their completed CEP Spreadsheets including information on their shortlisted Offers, the IOUs will work with the Energy Division to determine the appropriate AS price forecast to be used in the CEP valuation.

use and other variable costs will be provided in the Offers. The amount of charging used by an energy storage project will be determined by each IOU's dispatch modeling tool.

## **8. Network Upgrade Cost**

Transmission or distribution network-related costs will be part of the Offer's NMV. The IOUs may obtain and use results from Participants' interconnection studies, if available. Otherwise each IOU will develop and use its own estimate for transmission and distribution network upgrade costs.

Each Offer will include in its bid price the estimated cost of all the facilities needed to interconnect the project to the first point of interconnection with the transmission system grid. These facilities are referred to as direct assignment facilities, or "gen-ties". Because these costs are in the bid price, they are not included in the calculation of the transmission adder.

Network upgrades include all facilities that: (i) enable the project to be fully deliverable for RA counting purposes (upgrades after the point where a project's electricity first interconnects with and enters the subject utility's transmission grid); and (ii) transmit or deliver the full amount of power from the Project. Network upgrades include (a) transmission lines, (b) transformer banks, (c) special protection systems, (d) substation breakers, (e) capacitors, and (f) other equipment needed to transfer power to the consumer.

## **9. GHG Compliance Cost**

For any energy storage project that includes technology that generates GHG emissions, a GHG compliance cost will be calculated and included in the NMV.

## **10. Debt Equivalence Cost**

Long-term procurement contracts held by IOUs are treated by credit rating agencies as equivalent to long-term debt. This "debt equivalence" increases an IOUs borrowing costs.

## **11. Market Participation Costs**

For example, in order to arbitrage the day-ahead and RT market, the storage device must overcome the difference between the day-ahead and RT Grid Management Charge ("GMC") cost.

**F. Qualitative Information Included in the CEP Spreadsheet**

To incorporate some qualitative value that cannot be captured in the quantitative metrics, the CEP Spreadsheet also includes a grid of twenty ‘end uses’ as identified in the Decision Adopting Proposed Framework for Analyzing Energy Storage Needs<sup>11</sup> and listed in Table 3, below. For each offer, the utility will identify which end uses are associated with that offer. For each offer every end use will be scored with a “0,” “1,” or “2.” On this scale, “2” will mean “primary function” for an offer; “1” will mean “secondary function” for an offer; and “0” will mean “function not present” for an offer.

**Table 3  
End Uses Included in the CEP Spreadsheet**

1. Ancillary Services: frequency regulation	8. Intermittent resource integration: wind (ramp/voltage support)	15. Distribution peak capacity support (upgrade deferral)
2. Ancillary services: spin / non-spin / replacement reserves	9. Intermittent resource integration: photovoltaic (time shift, voltage sag, rapid demand support)	16. Distribution operation (voltage / VAR support)
3. Ancillary services: ramp	10. Supply firming	17. Outage mitigation: micro-grid
4. Black start	11. Peak shaving	18. Time-of-use (TOU) energy cost management
5. Real time energy balancing	12. Transmission peak capacity support (upgrade deferral)	19. Power quality
6. Energy price arbitrage	13. Transmission operation (short duration performance, inertia, system reliability)	20. Back-up power
7. Resource Adequacy	14. Transmission congestion relief	

Note: the benefit of all end uses is not simply a sum of the benefits for each end use. In some cases, allocating some portion of an energy storage project to one end use limits the ability of that portion of the energy storage project to satisfy any other end use. For example, since the same megawatt of capacity cannot provide both regulation up and spinning reserve at the same time, it

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<sup>11</sup> Decision Adopting Proposed Framework for Analyzing Energy Storage Needs (D.12-08-016), August 6, 2012, at 23.

cannot receive value for both of those end uses at the same time. However, in other cases, storage benefits can come from several sources. The benefits for any given megawatt of storage capacity (or fraction thereof) in any given hour, could come from multiple sources specified in the CAISO tariff (such as Resource Adequacy capacity, energy, and ancillary services) or from other sources, such as distribution or customer end uses. Further, different portions of capacity of the same storage project may receive value from different sources. For example, a 10 megawatt project could get value for 5 megawatts of regulation up and 5 megawatts of spinning reserve at the same time.