BEFORE THE PUBLIC UTILITIES COMMISSION OF THE

STATE OF CALIFORNIA

Order Instituting Rulemaking Regarding Policies, Procedures and Rules for Development of Distribution Resources Plans Pursuant to Public Utilities Code Section 769.	Rulemaking 14-08-013 (Filed August 14, 2014)
And Related Matters.	Application 15-07-002 Application 15-07-003 Application 15-07-006
(NOT CONSOLIDATED)	
In the Matter of the Application of PacifiCorp (U 901-E) Setting Forth its Distribution Resource Plan Pursuant to Public Utilities Code Section 769.	Application 15-07-005 (Filed July 1, 2015)
And Related Matters.	Application 15-07-007 Application 15-07-008

LOCATIONAL NET BENEFIT ANALYSIS WORKING GROUP FINAL REPORT

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Dated: March 8, 2017

Pursuant to the May 2, 2016 *Assigned Commissioner's Ruling (1) Refining Integration Capacity and Locational Net Benefit Analysis Methodologies and Requirements; And (2) Authorizing Demonstration Projects A And B* and the August 23, 2016 *Assigned Commissioner's Ruling Granting the Joint Motion of San Diego Gas & Electric Company, Southern California Edison Company, and Pacific Gas & Electric Company to Modify Specific Portions of the Assigned Commissioner's Ruling (1) Refining Integration Capacity and Locational Net Benefit Analysis Methodologies and Requirements; and (2) Authorizing Demonstration Projects A and B*,[1] and Administrative Law Judge Mason's *Email Ruling Granting Southern California Edison Company's Rule 11.6 Request For Extension*, Southern California Edison Company (U 338-E) respectfully submits the Locational Net Benefit Analysis Working Group's Final Report.

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[1] R.14-08-013, *Assigned Commissioner's Ruling (1) Refining Integration Capacity and Locational Net Benefit Analysis Methodologies and Requirements; And (2) Authorizing Demonstration Projects A And B*, May 2, 2016, Appendix A at p. 38; R.14-08-013, *Assigned Commissioner's Ruling Granting the Joint Motion of San Diego Gas & Electric Company, Southern California Edison Company, and Pacific Gas & Electric Company to Modify Specific Portions of the Assigned Commissioner's Ruling (1) Refining Integration Capacity and Locational Net Benefit Analysis Methodologies and Requirements; and (2) Authorizing Demonstration Projects A and B Southern California Edison Company*, August 23, 2016, Appendix A at p. 38.

Appendix

LNBA Working Group Final Report

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1 Executive Summary

Assembly Bill 327 (Perea 2013) established Section 769 of the California Public Utilities Code, which requires the Investor Owned Utilities (IOUs) to prepare Distribution Resource Plans (DRPs) that identify optimal locations for the deployment of distributed energy resources. In August 2014, the Commission began implementation of this requirement through Rulemaking (R.) 14-08-013, the Distribution Resource Planning (DRP) proceeding. A Ruling from the Assigned Commissioner in February 2015 introduced the concept of a unified locational net benefits methodology consistent across all three IOUs that is based on the Commission approved E3 Cost-effectiveness Calculator, but enhanced to explicitly include location-specific values and to include certain additional avoided cost components. A Ruling from the Assigned Commissioner issued on May 2, 2016 (May 2 ACR) adopted Locational Net Benefits Analysis (LNBA) methodology for use in DRP's Demonstration Project "B" (Demo B), and authorized the Utilities to pursue Demonstration Project B to perform LNBA methodology for one Distribution Planning Area (DPA) in each Utility's service area.

In addition to approving the LNBA methodology and approving the Utilities' Demonstration Project B, the May 2 ACR also established a LNBA Working Group (WG) to monitor and provide consultation to the IOUs on the execution of Demo B and further refinements to LNBA methods. The May 2 ACR identified four main purposes of the WG, namely, (1) monitor and support Demonstration Project B, (2) continue to improve and refine the LNBA methodology, (3) coordinate with IDER system-level valuation activities of the IDER cost-effectiveness working group, and (4) coordinate with the IDER solicitation framework working group where objectives may overlap (e.g., the definition and description of grid deficiencies vs. distributed energy resource (DER) performance requirements and contractual terms needed to ensure DERs meet the identified grid deficiencies).

Pacific Gas & Electric, Southern California Edison, and San Diego Gas and Electric submitted their final Demo B reports at the end of December 2016. These reports summarize demo results, lessons learned, and recommendations on methodology calculation and next steps regarding implementation of LNBA.

The May 2 ACR had clarified that the WG's activities were organized by (i) short-term work related to the Demo B and improvements to LNBA that could be adopted in a Q1 2017 Decision and (ii) longer-term work related to ongoing refinements to LNBA methodology beyond that time frame, conducted in parallel but not directly related to Demo B. Short term work should be addressed by the time of the submittal of the final Demo B report. The scope of WG's activities related to Demo B was defined in the ACR as, (a) recommend a format for the LNBA maps to be consistent and readable to all California stakeholders across the utilities' service territories with similar data and visual aspects (color coding, mapping tools etc.), and (b) consult to the IOUs on further definition of grid service, as described in the May 2 ACR, and in coordination with IDER proceeding. The WG additionally ended up discussing a variety of other long-term refinement topics not specifically outlined in the ACR. These discussions fall under the ACR-defined WG purpose of "continuing to improve and refine the LNBA methodology" and will be further discussed during the WG's long-term refinement period.

The purpose of the LNBA WG Final Report is to summarize recommendations made by the WG in order to allow the Commission to a make an informed decision regarding next steps, provide support to the CPUC to make a Proposed Decision on Demo B, assist the Commission in developing an implementation

plan for further development of LNBA, and outline refinements the WG believes need to be addressed before adoption and full system-wide rollout of an LNBA methodology and tool. These include identification of methodological refinements needed to enhance the LNBA in the future, potentially to address future use of LNBA.

After reviewing the IOU Demo B final reports, the WG developed the following overall recommendations:

- PG&E and SCE's Demo B projects meet compliance with the ACR, while SDG&E has yet to provide Demo B online maps;
- The current LNBA methodology is not yet ready for a system-wide rollout. LNBA methodology, as developed through Demo B, may be used on a provisional basis in the DRP and IDER pilots in two defined use cases (i.e., for information purposes, and as a tool to support identification of project deferral);
- LNBA methodology requires additional refinements before it can be implemented system-wide. These additional refinements fall under multiple categories, and the WG will endeavor to address many during its long-term refinement phase through additional analysis. The WG has not yet reached consensus on which refinements may be needed (and at what level of granularity), but have discussed recommendations in the following categories:
    - Replacing certain system values with local values
    - Developing a methodology to determine avoided transmission capital costs
    - Improving the presentation of LNBA information via tool and heatmap
    - Accommodating additional complexity in DER solutions
    - Broadening the analytical scope to account for additional distribution benefits and account for uncertainty
- Not all recommendations within the above categories received sufficient discussion during WG meetings, given the number of issues identified for refinement, to determine a clear consensus or non-consensus perspective from WG parties. These issues are summarized within the report's "discussion" section within each short and long term recommendation. Some Parties have provided input on these topics, but they should not be considered consensus/non-consensus, or reflective of a full WG discussion.;
- Disagreement exists whether LNBA may be used for purposes other than a tool to provide public information regarding optimal locations for DER deployment. Some parties believe that prioritization of refinements will vary based on potential future uses, and that Commission's guidance may be necessary to assist the WG in further scoping future uses of LNBA, as identified by the Energy Division in a February 1 memo which was written to "help inform the WG's recommendations in this report of how the LNBA could evolve beyond the Demo B methodology to meet the broader procedural needs for the analysis" [1];
- Most of the focus of the LNBA WG has been on creating a methodology for identifying opportunities to defer investments that are already in utility upgrade plans within a certain time

[1] During the period in which the WG was developing this report, CPUC Staff distributed a Memo to WG members discussing potential future uses of LNBA in other proceedings. The WG did not have sufficient time to discuss the memo within the context of WG meetings, and so while certain recommendations in the report may indirectly relate to various items contained in the Memo, the Report does not directly address or respond to the memo, which is available here: http://drpwg.org/wp-content/uploads/2016/07/CPUC-Memo-on-LNBA-Use-Cases-Feb-1-2017-mm7.docx

horizon. The WG determined additional discussion regarding long-term refinements will help determine whether the distribution deferral framework is the correct foundation for the broader issue of evaluating the overall locational benefits of DERs; and

- Commission guidance is requested to assist in prioritizing issues for WG consideration while acknowledging some topics may require substantive analysis. The LNBA WG expects to continue to work on long-term refinement items. The WG has identified a number of items for methodological refinement, but it has not yet determined how to prioritize its work going forward within the WG's long-term refinement phase.

WG discussions have been facilitated by More than Smart, and the LNBA WG has met at least once per month since May 2016. The WG is expected to maintain this meeting frequency through Q2 2017. Meetings have been in person or via webinar and conference call (see Appendix) and can be found at the WG website at www.drpwg.org.

2 Introduction and Background

Assembly Bill (AB) 327 of 2013 added section 769to the California Public Utilities Code, requiring each California Investor Owned Utility (IOU) to submit a Distribution Resources Plan (DRP) proposal "to identify optimal locations for the deployment of distributed resources…" using an evaluation of "locational benefits and costs of distributed resources located on the distribution system" based on savings distributed energy resources[2] provide to the electric grid or costs to utility customers.

Locational Net Benefit Analysis (LNBA), which evaluates DERs' benefits at specific locations is one of several new analytical methods needed to achieve the future envisioned in the DRP - one where DERs are deployed at optimal locations, times, and quantities so that their benefits to the grid are maximized and utility customer costs are reduced.

In a May 2, 2016 ruling,[3] the PUC directed the IOUs to demonstrate LNBA methodology – in particular, how to quantify DER benefits to the transmission and distribution (T&D) system – at a high level of granularity. This LNBA WG report provides recommendations on LNBA in response to the completion of that demonstration (Demo B) to inform a future Commission Decision on further evolution of LNBA.

In accordance with the May 2, 2016 ACR in the DRP proceeding[4] (R-14-08-013), the LNBA Working Group was established to monitor and provide consultation to the Investor Owned Utilities (IOUs) on the execution of Demonstration Project B and further refinements to LNBA methodology. CPUC Energy Division staff has oversight responsibility of the WG, but it is currently managed by the utilities and interested stakeholders on an interim basis. The utilities jointly engaged More Than Smart to facilitate the WG. The Energy Division may at its discretion assume direct management of the WG or appoint a WG manager[5].

[2] Per AB 327, DERs includes distribution-connected energy efficiency, energy storage, distributed generation, demand response, and electric vehicles.
[3] Available here: http://docs.cpuc.ca.gov/SearchRes.aspx?docformat=ALL&docid=161474143
[4] A modified ACR was granted on August 23 to modify specific portions of the May 2, 2016 ACR. http://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M166/K271/166271389.PDF
[5] ACR R-14-08-013 Section 6: "LNBA Working Group"

2.1 LNBA Demonstrations

The May 2 ACR approved an LNBA methodology framework for Demo B, instructed the IOUs to apply the LNBA methodologies to one or more Distribution Planning Area(s) (DPAs), and directed the IOUs to submit a final report and results by the end of 2016.[6] The table below from the May 2 ACR lists the components of the LNBA as defined for Demo B, and, for each, indicates a basic or "primary" LNBA methodology as well as a more complex "secondary" option.[7]

Table 1: Approved LNBA Methodology Requirements Matrix for Demo Project B

Table 2 Approved LNBA Methodology Requirements Matrix for Demonstration Project B.

Components of avoided costs	Proposed LNBA in IOU Filings	Primary Analysis	Secondary Analysis
from DERAC	*from IOU applications*	*Required*	*Optional additional*
Avoided T&D	**Sub-Transmission / Substation / Feeder**	**As proposed but with modifications (1)**	**As proposed but with modifications (1)**
	Distribution Voltage / Power Quality	**As proposed but with modifications (1)**	**As proposed but with modifications (1)**
	Distribution Reliability / Resiliency	**As proposed but with modifications (1)**	**As proposed but with modifications (1)**
	Transmission	**As specified herein (2)**	**As specified herein (2)**
Avoided Generation Capacity	System and Local RA	Use DERAC values	Use DERAC values with location-specific line losses (3)
	Flexible RA	Use DERAC values with flexibility factor (4)	Use DERAC values with flexibility factor (4)
Avoided Energy	Use LMP prices to determine	Use DERAC values	As proposed but with modifications regarding use of LMP prices (5) and location-specific losses (3)
Avoided GHG	incorporated into avoided energy	Use DERAC values	As proposed
Avoided RPS	similar to DERAC	Use DERAC values	As proposed
Avoided Ancillary Services	similar to DERAC	Use DERAC values	As proposed
additional to the DERAC	Renewable Integration Costs	values or descriptions of these benefits (6)	values or descriptions of these benefits (6)
	Societal avoided costs	values or descriptions of these benefits (6)	values or descriptions of these benefits (6)
	Public safety costs	values or descriptions of these benefits (6)	values or descriptions of these benefits (6)

[6] Ibid, at pp. 25-34.
[7] ibid, at pp. A26-A27.

The T&D avoided costs, highlighted in bold font in the ACR table above, are the central focus of Demo B, since they are the LNBA components most sensitive to location.[8] Most non-T&D components of the LNBA in Demo B are borrowed from the existing DER Avoided Cost calculator (DERAC) [9] or are expansions upon the DERAC in the case of flexible and local RA and renewable integration cost. These non-T&D components are sometimes collectively referred to as system-level avoided costs.

Each IOU followed the high-level process below in applying the Commission's guidance in the LNBA demonstration projects:

1. Select one or more DPAs that include "one near-term and one longer-term distribution infrastructure project for possible deferral"[10] and "at least one voltage support/power quality- or reliability/resiliency-related deferral opportunity in addition to one or more capacity-related opportunities;"[11]
2. Identify, for every location in the selected DPA(s), "the full range of electric services that result in avoided costs" including "any and all electrical services associated with distribution grid upgrades identified in (i) the utility distribution planning process, (ii) circuit reliability improvement process and (iii) maintenance process;"[12]
3. Prepare, for each location with an identified upgrade, a location-specific service specification, identify capabilities that are required of incremental DERs to provide that service;
4. Compute, for each location, a project deferral avoided cost that could be attributed to incremental DERs that meet the required capabilities and apply the approved LNBA methodology to calculate LNBA results;
5. Execute these steps under two different distribution planning DER growth scenarios: (a) the Utilities' base distribution planning scenario and (b) the Very High scenario as filed in the July 2015 DRPs;
6. Make the results available via a heat map along with the DER growth scenario data on the Integration Capacity Analysis map;
7. Provide access to software and data used in Demo B and coordinate with the LNBA Working Group in monthly meetings and to coordinate with the Integrated Distributed Energy Resources (IDER) proceeding

The IOUs, in consultation with the LNBA WG, adopted the IDER Competitive Solicitation Framework Working Group's (CSFWG's) final consensus list of distribution services that DERs can potentially provide. The IOUs also, with help from a consultant, developed a public LNBA Tool which was used to calculate a total avoided cost for all locations within each DPA, including T&D upgrade deferral avoided cost for locations with a deferrable upgrade (i.e. an upgrade providing one of the services identified by the CSFWG. This LNBA Tool is based on the May 2 ACR's "primary" LNBA methodology framework

[8] Note that Table 2 of the ACR[8] does not include DER costs – either the cost to procure or the cost to interconnect – as a LNBA component in Demo B, so the LNBA in Demo B is not a full net benefit analysis.
[9] https://ethree.com/public_projects/cpuc4.php
[10] ibid, at pp. A25.
[11] ibid, at pp. A25.
[12] ibid, at pp. 28.

described above; however, the LNBA Tool is designed to easily incorporate many refinements, including several that are reflected in the secondary analysis.

The IOUs also jointly designed their heat maps that provide a visual depiction of Demo B's LNBA results. Each feeder is color coded to provide indicative LNBA results per the following key:

Table 2: Demo B LNBA Results Heat Map key

$	Indicates only system-level avoided costs and no T&D deferral value
$$	Indicates system-level avoided costs plus 0 to < 100 $/kW deferral value
$$$	Indicates system-level avoided costs plus 100 to < 500 $/kW deferral value
$$$$	Indicates system-level avoided costs plus > 500 $/kW deferral value

Further information, including a downloadable version of each IOUs' Demo B final report and links to the public tool and heat maps are available at More Than Smart's DRP Working Group website.[13]

2.2 LNBA Working Group (WG) Role

The activities of the WG are organized by (I) short-term work related to the Demonstration Project B and improvements to LNBA that could be adopted in a Q1 2017 Decision and (II) longer-term work related to ongoing refinements to LNBA methodology beyond that time frame conducted in parallel, but not directly related, to the Demonstration B. Short term work should be addressed by the time of the submittal of the final Demonstration B report.

The short-term work of the WG is defined in the ACR under Section 6.1:

6.1 Activity related to Demonstration Project B

a. *Recommend a format for the LNBA maps to be consistent and readable to all California stakeholders across the utilities' service territories with similar data and visual aspects (color coding, mapping tools etc.).*
b. *Consult to the IOUs on further definition of grid service, as described in requirement (1)(B)(iv-v) of Section 4.3.1 above, and in coordination with IDER proceeding.*

The WG and IOUs met monthly throughout the Demo B process: major decisions (e.g. adoption of the CSFWG service definitions) were made in consultation with the WG, and WG feedback was incorporated into the design of the LNBA tool and heat maps. In particular, the LNBA WG expressed strong support for using technology-agnostic approaches to evaluating location-specific benefits in Demo B. The methods and tools reflected in this Demo B are therefore designed, to the maximum extent possible, to easily evaluate any DER or combination of DERs. In addition to these specific tasks, the ACR specified long-term work of the WG under Section 6.2: "Activity related to Continuing Refinements to LNBA." This report also summarizes WG discussions to-date with regards to continuing refinements.

[13] Located here: http://drpwg.org/sample-page/drp/

2.3 WG Meetings and Topics Discussed

The WG launched on May 12, 2016, and included a total of 17 meetings over 10 months, with the latest meeting occurring on March 2, 2017. The WG discussed many different topics relating to both the methodologies and final deliverables and results of Demo B as well as long-term refinements to LNBA.

A full summary of meeting dates and topics, as well as a list of parties involved in drafting of this report, may be found in the Appendix. The DRP WG site contains additional documentation of meeting agendas, presentation slides, and participant lists.

2.4 Summary of LNBA WG Recommendations

The WG collectively developed a list of recommendations from multiple organizations at the January 20 WG meeting. These recommendations are categorized as follows:

1. Recommendations regarding uses of LNBA and regulatory process;
2. Recommendations for the LNBA tool and methodology as short-term activities;
3. Recommendations for long term refinements to LNBA methodology.

Overall, the WG has reviewed the Demo B projects and determined their compliance with the ACR. The WG additionally notes that further methodological refinements are needed and have engaged in some of those discussions given the ACR directive for the WG to continue to improve and refine the LNBA methodology. There is further non-consensus on whether the LNBA tool developed under Demo B as developed is sufficient for the two proposed use cases proposed at the beginning of the WG process (for reference, see Section 3.2). The WG additionally recognizes that several Commission proceedings and initiatives are looking to the LNBA to develop location-specific avoided cost values for use in various cost-effectiveness analyses, which are primarily identified but not yet fully developed through other CPUC proceedings. Without full clarity on these identified use cases, many WG members do not feel that a conversation on what can and cannot be considered in LNBA methodology is helpful at the time of this report due date with full certainty. However, it is recognized that documenting the discussion topics at hand is helpful as the Commission begins to develop a roadmap on additional methodological refinements needed to facilitate the potential additional use of LNBA within this context.

Table 3: Summary List of LNBA WG recommendations

	Recommendation	Consensus Status	CPUC Policy Guidance Needed
3	*Use Cases, Regulatory Process*		
3.1	*Demo B projects have been completed as required*		
	IOU Demo B Projects Satisfy all CPUC Requirements	Consensus (SCE, PG&E) Non-Consensus (SDG&E)[14]	yes
3.2	*Use Cases*		
	Refine tool to support how LNBA may inform future sourcing options	Non-Consensus	yes
	LNBA methodology and tool may be used on a provisional basis in the IDER and DRP pilots	Consensus	yes
3.3	*Regulatory Process Recommendations*		
	Deferral Framework adoption prior to LNBA system-wide implementation	Consensus	yes
4	*Short term activity: improvements to LNBA that could be adopted in a Q1 2017 decision*		
4.1	*LNBA Tool Functionality: improving the heat map and spreadsheet tool*		
	Tool should include DER profiles and automatically populate output	Consensus	
	Allow multiple locations/multiple projects	Consensus	
	Include VAR profiles for voltage-related upgrades	Consensus	
	Clarify renewable integration cost	Non-Consensus	
4.2	*Bulk System Benefits: Refinement to existing LNBA Values*		
4.2.1	*Replace system values with local values*		
	Develop locational specific avoided cost values for energy and capacity	Consensus	
	Assess variability in location-specific line losses	Consensus	
4.2.2	*Avoided transmission capital and operating expenditures*		
	Form technical subgroup to evaluate potential methodologies for avoided transmission costs	Consensus	Yes
5	*Long-Term Discussion and Potential Refinements on LNBA Methodology*		
5.1	*Consideration of locational benefits beyond those identified in distribution planning process*		
5.1.1	*Account for uncertainty in distribution planning process*		
	Examine methods to reduce uncertainty in planning and utility investment	Non-consensus	
	Incorporate uncertainty metric in LNBA tool for planned deferrable projects	Non-consensus	
	Develop a methodology to incorporate deferrable projects that may occur unexpectedly (i.e., unplanned projects)	Non-consensus	
5.1.2	*Incorporation of additional values into the LNBA*		
	Value locational value of DERs beyond 10 years	Non-consensus	
5.2	*Distribution Benefits: Analytical Scope and Analytical Benefits*		
5.2.1	*Analytical Scope*		
	Including Cost of DER Penetration	Non-Consensus	
	Use Base Growth Scenario Only	Non-consensus	
5.2.2	*Additional Benefits*		
	T&D values to be included in future modifications of LNBA Tool should only reflect values with established quantification	Non-Consensus	Yes
	Asset life extension	Non-Consensus	
	Situational awareness or intelligence	Non-Consensus	

[14] SCE and PGE were in full compliance, SDG&E complied with all aspects of ACR except Section 4.4.2, i.e., SDG&E is still working to make results of their LNBA available via heat map, as a layer with the ICA data in an online ICA map.

	Increased reliability (non-capacity related):	Non-Consensus	
	Evaluating Planned Upgrades Meant to Accommodate Additional DER Growth	Non-Consensus	
	Avoiding Maintenance Projects	Non-Consensus	
	Downsizing Replacement Equipment	Non-Consensus	

Each recommendation is presented in a consistent table format, with information as follows:

Table 4: Recommendations table format

Recommendation	**Short name of recommendation**
Recommendation or Discussion	Recommendation or continued discussion needed with additional understanding of future LNBA use
Consensus?	Consensus or non-consensus
Action type	Three possible Categories: • *CPUC Policy Guidance or CPUC clarification*: WG recommends CPUC clarify policy to govern use/application/implementation of LNBA • *IOUs to implement modification*: WG Recommends IOUs implement modification to the functionality, scope, methodology of the tool. • *WG to analyze further*: WG has identified a potential modification to the LNBA methodology, but further research/analysis is necessary before a final determination can be made of how/if such a modification should be implemented
Description	Simple description of what the recommendation is seeking
Supporting Arguments	Arguments in favor of the recommendation
Opposing Arguments	Arguments against the recommendation

Each section of this report contains (1) an objective section, (2) a summary of discussion, and (3) a recommendations or discussions section. This last section of recommendations and discussions additionally marks current consensus/non-consensus status based on WG discussions up until the time of this report. WG discussions will continue on long-term refinement topics.

3 Discussion and Recommendations: Use Cases, Regulatory Process

Section 3 compiles general comments about the use of LNBA and recommendations for how work on LNBA should progress. In contrast with other categories, these recommendations are not concrete methodological improvements.

3.1 Demo B Projects Have Been Completed as Required

Objective

This section expresses the WG consensus that IOU Demo B implementations are fully compliant with all requirements as set forth in the May 2nd and August 19th Assigned Commissioners Rulings.

Discussion

Parties have many diverse recommendations and expectations for how the LNBA should be developed and refined prior to further implementation. However, parties recognize and agree that the LNBA as implemented in each IOU Demo B project is consistent with the specific CPUC requirements for the Demos. These requirements were primarily established in an Assigned Commissioners Ruling dated May 2, 2016, with some minor changes implemented through an Assigned Commissioner's Ruling Dated August 19.

Recommendation	**IOU Demo B Projects Satisfy all CPUC Requirements**
Consensus?	Consensus (SCE and PG&E); Non-consensus (SDG&E)[15]
Action type	CPUC Policy
Description	The WG recommends that the CPUC formally recognize that IOU Demo B projects and reports are fully compliant with CPUC directives and requirements as set forth in the May 2nd and August 23rd ACRs, wherein the IOUs are asked to evaluate DERs in locations against planned utility upgrade projects. Additionally, the methodology used in Demo B is appropriate to use provisionally in related IDER and DRP pilots that have been identified in the near-term, including IOU's Demo C and the Distribution Investment Deferral Framework.
Supporting Arguments	See IOU Demo B Final Reports for complete explanation of how each project and report complies with the requirements. PG&E and SCE's demo projects have satisfied all requirements in compliance with the ACR.
Opposing Arguments	SDG&E still has not provided a fixed link to its LNBA map.

3.2 Use Cases

Objective
This section provides commentary on use cases for the LNBA tool and overall methodology.

3.2.1 Use Cases Discussed During Development of Demo B

Discussion
In completing the short-term activities, the IOUs developed an LNBA tool through Demonstration B in coordination and consultation with the WG. The LNBA tool is designed as a public tool and heat map utilizing public indicative values. The tool and heat map does not provide market-sensitive information, nor does it provide confidential data from utilities. WG members have been presented with the following set of applications for the LNBA tool, as proposed by the IOUs during the May, June, and July 2016 WG meetings:

[15] Ibid, Footnote 14.

1. **LNBA Public Tool ("tool") and heat map to provide public information:** LNBA provide a heat map and data that customers and DER providers can use to identify potential optimal locations for deploying DER, along with detailed information about the required attributes necessary to achieve upgrade deferrals. Demo B provides an example of this use case. The final public heat maps are a feeder-level visual representation of where DERs can defer or avoid planned utility infrastructure projects. Deferral opportunities would be identified in the Distribution Investment Deferral Framework (DIDF), currently under development in DRP Track 3, Sub-track 3. The developed LNBA tool serving this use case employs public data and indicative values to identify locational and system-level benefits, in addition to specific identified project deferral value where applicable. The tool is technology-agnostic, and users may input a profile representing a specific DER or portfolio of DERs in a location to receive technology-specific estimates of the avoided cost, or that their DER project would provide. Data available for use in the LNBA tool that shows hourly load reduction needed in a given location to defer a planned upgrade may help developers create DER solutions that are designed specifically to defer or eliminate that planned upgrade.

2. **Prioritizing DER deferral opportunities:** Components of the LNBA methodology may be used to develop a prioritization of DER deferral opportunities by utilities. Specifically, the analysis of T&D benefits that drives the LNBA tool relative to the magnitude and duration of required electrical characteristics to achieve cost deferral may be useful in prioritizing deferral opportunities. This prioritization process is a step in the Deferral Framework as proposed by the IOUs in the Deferral Framework Workshop (organized by CPUC as part of Track 3, sub-track 3). As with other steps in the Deferral Framework, the prioritization process would be reviewed with the Distribution Deferral Advisory Group (DDAG), a proposed stakeholder group in the DIDF that would provide feedback and advises the selection of deferral opportunities for solicitation via the Competitive Solicitation Framework (developed in the IDER proceeding). Some components of the tool would likely not be used in this process, for example, system-level components based on DERAC values.

The use cases described above require a clear understanding of the connection between the Deferral Framework and the LNBA tool. Both are based upon the same distribution planning activities and analyses: forecasting, needs assessment, and evaluation of alternatives to meet identified needs. The Deferral Framework will determine which of those needs may potentially be deferred or met by targeted DERs. The subsequent list of potentially deferrable projects, including the attributes required to achieve the deferral, will be an important input into the LNBA tool. The LNBA tool will combine the distribution deferral benefits and requirements with additional benefits related to the bulk system (transmission benefits, capacity benefits, CAISO market benefits.)

As a very detailed output of the distribution planning process that is shared publicly and is also used in part to help make deferral decisions that are subject to external stakeholder input, the LNBA tool and heat map can increase transparency in utility planning and provide some visibility into distribution planning.

3.2.2 Additional Use of LNBA Methodology

Discussion

The development of the LNBA Tool within Demo B represents a major step forward in providing DER developers with data on grid needs and indicative deferral values. However, it is emphasized that the LNBA tool addresses the narrow question of evaluating DERs in single locations against certain distribution upgrades that are already in IOU distribution system plans, and should not be construed as the advancement of a comprehensive, location-specific utility avoided cost calculator that could be used to proactively identify high-value locations for DER deployment. The LNBA tool as developed under Demo B was designed as a public tool, using public indicative values – it does not use or provide market-sensitive information, nor does it provide internal data from utilities. The tool as developed under Demo B is not appropriate to be used to support sourcing decisions.

During WG discussions, members of the WG reached disagreement whether the LNBA tool has any applicability outside of the two identified uses as developed under Demo B. To provide clarification as per the ACR16, the CPUC Energy Division developed a memo17 to expand upon this discussion, stating that "a number of Commission proceedings and initiatives are looking to the LNBA to develop location-specific avoided cost values for use in various cost-effectiveness analyses to indicate high-value locations for DER deployment, inform resource procurement decisions, and develop location-specific rates or tariffs for DERs." These specific proceedings/initiatives are discussed below. The full memo may be found in the Appendix.

3. **Integration of Distributed Energy Resources (IDER) proceeding (R. 14-10-003):** the IDER identifies that LNBA may be used in the 1) development of a unified cost-effectiveness framework18 that can be used for technology-agnostic resource evaluation, and 2) identification of tariffs, contracts, or other mechanisms for the deployment of cost-effective DERS, and cost-effective methods of effectively coordinating existing Commission-approved programs, incentives, and tariffs to maximize locational benefits and minimize incremental costs of DER resources;
4. **Net Energy Metering 3.0 (D. 16-01-044):** the NEM successor tariff decision cited the ongoing work in DRP and IDER to defer significant changes to NEM incentive levels. Development of the NEM successor tariff is expected to consider LNBA-derived locational values;
5. **Integrated Resource Planning (R. 16-02-007):** Future cycles of the IRP process post-2018 may utilize locational values as an input to help inform resource net cost estimates.

While the WG has reviewed the CPUC Energy Division memo and understand to some extent where LNBA methodology may have future application, the WG has not comprehensively studied each use case and determined which refinements (and at what level of granularity) may be applicable for each use case. The WG acknowledges that all options may remain on the table given that further clarity is needed

[16] ACR Page A38 states: "Energy Division may provide further direction regarding the content and format of the report."
[17] ibid,at pp. 3
[18] R.14-10-003 Order Instituting Rulemaking, October 2, 2014, http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M116/K116/116116537.PDF, p. 11.

around potential future use cases. However, certain IOU parties believe that LNBA is a tool to provide indicative information to various stakeholders, but that it should not be used in any sourcing decisions or DER compensation decisions.

The WG proposes that it spend a significant amount of time in the long-term refinement phase to determine how the LNBA tool and map may meet the needs of the use cases identified for the LNBA, pending additional guidance from the Commission. The WG requests additional Commission guidance on whether the LNBA tool may have additional uses outside the two identified from Demo B, and if so, to provide relative prioritization of expected uses of LNBA in the future. This guidance will assist in facilitating WG discussion within this scoping exercise and allow the WG to have a more informed discussion on prioritization, as well as which refinements are feasible to implement within certain time frames.

It is important to identify time considerations such as improvements that need to be made before future iterations of the tool are made, within the context of IOU ability to develop and incorporate changes, and in relationship to proposed timing of other proceedings. Some WG members also feel it is important to identify specific refinements and methodological changes that need to take place to enable the future use case, including the potential development of new methodological approaches, given that, per the Energy Division memo, the LNBA is envisioned to provide an avoided cost value to indicate high-value locations for DER deployment, inform resource procurement decisions, and inform development of programs, rates or tariffs for sourcing DERs.

The WG spent significant effort reviewing the LNBA methodology and tool in the context of Demo B in 2016, and collectively agree that the LNBA methodology as developed is not yet sufficient to meet identified use cases, and can only do so after addressing the methodological changes and improvements to the tool. In addition, WG participants have identified a number of cross-cutting issues related to the use cases which are not clearly within the WG scope, but present a challenge when considering how LNBA can be linked to programs, tariffs and rates in a way that satisfies the objectives of section 769 – deploy cost-effective DERs that satisfy distribution planning objectives; coordinate existing programs, incentives and tariffs to maximize locational benefits and minimize incremental costs of DERs; seek net benefits to ratepayers. Several of these are provided below:

- How do we ensure that DERs reliably provide distribution services, and how do field demonstrations help test this capability?
- What is the nature of interactions between current programs and cost effectiveness and future targeted programs and granular cost effectiveness? Does one replace the other? Do DERs adopted under one vs the other need to be differentiated? Does introducing a granular T&D avoided cost in cost-effectiveness require re-evaluation of the generic T&D avoided cost?
- How are targeted programs, tariffs, rates crafted to ensure that benefits are truly captured when needs are very dynamic and very specific in location, timing and duration, and how does LNBA enable this?

Members of the WG have differing opinions on whether future refinements to the LNBA tool to support its uses in sourcing should reflect public indicative values, or actual values that may be considered

market-sensitive data, or internal utility data. From the IOU perspective, using confidential data would mean the results of the analysis could no longer be shared with the public. Many other members of the WG believe that the use of LNBA as a tool to support sourcing options may require more detailed and accurate locational values (some of which may be internal or market sensitive), and that the WG should fully consider potential future uses of the tool to direct DER deployment in a manner that maximizes net benefits before limiting which values the tool may use.

Recommendations

Recommendation	**Refine tool to support how LNBA may inform future sourcing options**
Consensus?	Non-Consensus
Action type	WG to analyze further
Description	Many refinements are identified in this document which support improvements to the LNBA tool so that it may provide the most value within the utility planning process and meet the needs of the tool to support sourcing options (as currently defined through the Energy Division memo). The type of sourcing option will determine cost visibility for utility planners as well as what timeline and reliability a planner can consider a DER able to provide. All this information will be critical to ensuring the best planning decisions are made. This would provide the necessary linkage between the LNBA and IDER processes, ensuring informed and effective decisions can be made regarding various potential sourcing options. One such linkage relates to improving the locational granularity of avoided cost in the IDER cost-effectiveness track. Another linkage relates to other DER sourcing mechanisms that may be developed in the IDER, such as location-specific DER programs or tariffs. Until these improvements are made, the tool is not capable of meeting the broader application of LNBA beyond the current Demo B scope. The WG expects to evaluate how the LNBA tool meets the needs of future applications and accompanying modifications, as a priority item during long-term refinement. The WG has included a long list of potential refinements to the LNBA tool and methodology in this report, and plan to determine which refinements may be needed for which future use, and at what level of granularity. There are further questions regarding how these values would be reflected in a spreadsheet tool. The WG will address this as it continues to discuss uses of LNBA in long-term refinement and has already identified it as an issue of consideration within the intermediate status report on LNBA refinement.
Opposing Arguments	Some Parties believe that even with refinements, the LNBA tool cannot or should not be used in any form of DER sourcing.

Recommendation	**LNBA methodology and tool may be used on a provisional basis in IDER and DRP pilots**
Consensus?	Consensus
Action type	CPUC policy guidance
Description	The methodology used in Demo B is appropriate to use provisionally in related IDER and DRP pilots that have been identified in the near-term, including IOU's Demo C and the Distribution Investment Deferral Framework. The IOUs will endeavor to include the additional consensus refinements detailed in the *Bulk System Benefits: Refinement to existing LNBA Values* section.

3.3 Regulatory Process Recommendations

Objective

This section includes recommendations on an appropriate regulatory process including various steps that should occur prior to further implementation of LNBA.

Discussion

This section discusses connection and timing in coordination with the Distribution Infrastructure Deferral Framework. The DIDF will determine which grid upgrades are deferrable by DERs, which is an essential step prior to evaluating the benefits of those deferrals across the system using LNBA.

It is expected that full system-wide implementation of LNBA will require significant resources. There are many questions about modifications to LNBA; various modifications impact the cost of LNBA implementation. As the future scope is not yet well defined, neither schedule nor budget are well defined or understood. Members of the WG have suggested several means of defining a budget for further LNBA work – overall, it is recommended by all Parties that defining a scope and budget for future LNBA refinements to meet identified uses should include input from Parties and the PUC.

Recommendations

Recommendation	**Deferral Framework should be adopted before the LNBA tool and heat maps are deployed system-wide**
Consensus?	Consensus
Action type	CPUC Policy Guidance
Description	Prior to system-wide implementation, the Distribution Infrastructure Deferral Framework (DIDF) envisioned under DRP Track 3 should be adopted. The Distribution Infrastructure Deferral Framework is a key input into the LNBA and has yet to be finalized as part of Track 3 of R.14-08-013. As discussed in the IOU presentation at the Deferral Framework workshop, IOUs plan to use technical screens to identify which projects are

	deferrable. LNBA may have value in helping market participants provide input into the prioritization of deferral opportunities. The IOUs envision the use of LNBA within the Deferral Framework as the following, while stakeholders of the LNBA WG request additional clarity regarding the deferral process: • LNBA will start with the list of deferral projects and attributes, and add in indicative public values, to identify optimal locations for DER deployment. The projects used for LNBA is the same set of projects that is the output of the Deferral Framework. The LNBA will calculate the T&D benefit for each project using indicative values. The LNBA also adds in system-level values from the DERAC tool. These public values are not used in internal processes. CPUC adoption of a deferral framework is necessary so that IOUs and the LNBA WG have clear direction on how the LNBA analysis will be used in the distribution deferral process.

4 Short Term Activity: Improvements to LNBA

This section summarizes recommendations made after review of IOU Demo B reports that support improvements to the LNBA methodology and tool by refining existing bulk system benefits within the LNBA methodology, and improve how information is presented within the LNBA tool and corresponding heat map. The WG understands that many of these refinements will require additional resources and analysis to implement, and will not be in place to be immediately implemented if a Q1 2017 decision is made on these LNBA refinements. The LNBA should not be approved for system-wide implementation until multiple questions regarding its future use are addressed. The WG agrees to continue working on the following refinements within the long-term refinement period.

4.1 LNBA Tool Functionality: Improving the Heat Map and Spreadsheet Tool

Objective

This section discusses improvements identified so far to improve how information is presented on the heat map and in the LNBA tool. This section does not consider changes to the underlying benefits analysis; those recommendations are discussed in the "Analytical Scope and Additional Benefits" section.

Two categories of improvements are made: 1) refining the tool to improve its accuracy; 2) determining further revisions to the tool and map.

Discussion

The spreadsheet tool created as part of Demo B allows stakeholders to develop a profile for a DER project and evaluate it against indicative values for deferring projects in the relevant distribution planning area that the utility has identified as deferrable. To show the results of Demo B on a visual map, IOUs color coded each feeder representing indicative LNBA results. The heat maps provide results over three time periods (short, medium, long term) and over two DER growth scenarios specified in the ACR. The maps are made publicly available and uses the same platform as the ICA map for ease of use. In addition, IOUs made feeder-level data publicly available through an online downloadable dataset.

The current LNBA tool is not designed to make assumptions about the performance of any particular resource. Rather, the LNBA tool provides information on the need, and the user can provide assumptions about a given resource. Sample profiles can be included in the LNBA tool. However, these would be "illustrative only."

The LNBA tool requires users of the tool to provide basic DER information, benefits that the DER can obtain, and a DER hourly profile. One component that a prospective project developer is required to input is a "local area dependability" value under the "DER Settings and Full Local T&D Avoided Cost" tab. This input is meant to scale the DER profile up or down. As it is currently applied, the dependability factor does not actually reflect whether a project more or less "dependable". Different DER types will have different impacts on load reduction based on many factors. Dependability metrics need to be defined to increase confidence level in projected DER performance.

Dependability is a sourcing question and therefore should be considered in discussions of sourcing mechanisms within the IDER proceeding (R.14-10-003). LNBA provides needed attributes. It is a sourcing question of whether any resource (or resource portfolio) provides those attributes. For competitive solicitations, IOUs will evaluate dependability as part of the bid evaluation process. For programs and tariffs, dependability assumptions should be established as part of the program rules.

The following revisions improve functionality of the map: 1) populating standard DER profiles to allow basic analysis by stakeholders; 2) modifying the tool so it can include multiple DER solutions; and 3) revising the tool to include VAR profiles for voltage-related upgrades. Finally, the WG requests that the Commission clarify how "integration costs" should be captured in the tool.

Recommendations

Recommendation	**Tool should include DER profiles and automatically populate output**
Consensus?	Consensus
Action type	IOUs to implement
Description	The Tool should include an option to select a typical or generic hour DER generation profiles and automatically populate output, rather than only having a manual input option. Ideally, the user would input a DER (solar PV, wind, solar PV+ storage, uniform generation, etc.) and the capacity of the DER (KW, MW) – the tool would then calculate an hourly generation profile and populate the fields, based on either local or state inputs. NREL's PV Watt tool comes to mind

	and perhaps similar locational data could be incorporated for solar (or wind) in the tool. Sample profiles may be included in the LNBA tool. However, these would be "illustrative only." An actual resource would not be guaranteed to perform similar to the same profile. WG will review which profiles may be added in a resource library within the LNBA public tool, considering what resources may already exist (e.g., EM public tool, typical solar PV and EE profiles, etc.)

Recommendation	**Allow multiple locations / multiple projects**
Consensus?	Consensus
Action type	IOUs to modify tool
Description	The LNBA Tool should be refined to allow for modeling of a portfolio of projects, as a DER alternative to a larger distribution upgrade may require a portfolio of projects at numerous nodes. A combined portfolio of DER capacity may provide deferral at a substantially lower cost than a single offer, particularly if customer DER capacity is divided among multiple separate aggregators. Under the existing tool, if two DER capacities are offered, which individually would not fully meet a defined need but would meet the need as a combined portfolio, the capacities would receive zero valuation. The WG should enhance the LNBA tool to support benefit analysis of deferring a project with multiple locational elements.

Recommendation	**Include VAR Profiles for Voltage-Related Upgrades**
Consensus?	Consensus
Action type	WG to analyze further
Description	Demo B LNBA tool captures DERs' ability to defer voltage support projects, but only captures DERs' ability to reduce load via the user-input hourly DER profile, which does not capture of the ability of some DERs to produce or absorb reactive power as a way to avoid voltage-related investments (i.e. provide voltage support service). Incorporating tool functionality to take an 8760 VAR requirement input and DER VAR profile is not complex. However, developing that hourly VAR deficiency values will take additional engineering analysis. DERs can potentially provide voltage support in areas where customers experience low/high voltage conditions outside of Rule 2 limits. Voltage support services are planned capital investments needed to correct excursions outside voltage limits and supporting conservation voltage reduction strategies in coordination with utility voltage/reactive power control systems.

	In the existing LNBA tool, voltage support project deferral requirements are expressed in terms of load reduction rather than reactive power injection or absorption. This ensures that non-inverter-based DER technologies such as energy efficiency can be evaluated as DER solutions to deferrable voltage support projects.
Supporting Arguments	The May 2nd Assigned Commissioner's Ruling calls for "methods for valuing location-specific grid services provided by advanced smart inverter capabilities. Examples include the following seven smart inverter functions identified by the Smart Inverter Working Group: (i) DER Disconnect and Reconnect Command, (ii) Limit Maximum Real Power Mode, (iii) Set Real Power Mode, (iv) Frequency-Watt Emergency Mode, (v) Volt-Watt Mode, (vi) Dynamic Reactive Current Support Mode, and (vi) Scheduling power values and modes." As it was developed, the LNBA tool is unable to value these services, instead valuing voltage reduction only where possible through load management. Voltage support, which is already a component of LNBA, can be provided by reducing/increasing load (a capability that all DERs have) or by injecting/absorbing reactive power (a capability of DERs with smart inverters). This recommendation would expand the way in which the voltage support project deferral requirements are stated so that smart inverter-based DERs could provide meet the deferral requirements through reactive power management. Demo B only focuses on hourly load reduction needed to avoid a planned upgrade. This does not effectively capture the ability of some DERs to provide voltage support via VARs. DERs produce reactive power to avoid voltage-related investments. In addition to the load reduction requirement calculated in the LNBA Tool for thermal and safety constraints, the LNBA Tool should have a reactive power production requirement for voltage constraints. The ability for DERs to provide reactive power for planning purposes has yet to be determined. Other working groups, including ICA, are developing use cases to determine how DERs can potentially provide reactive power support. Increased visibility of voltage and reactive power levels is required throughout the distribution system to determine when and how IOUs would communicate with DERs to provide appropriate VAR levels in real time.

Discussion	**Clarify Renewable Integration Cost**
Consensus?	Non-Consensus
Action type	CPUC to clarify
Description	*Renewable Integration cost:* The 5/2/2016 ACR directed the IOUs to include "renewable integration costs" in the LNBA for Demo B.

	As described in all three IOUs' reports, the IOUs included the renewable integration cost adopted in D.14-11-042 in the RPS proceeding. These costs apply to stand-alone wind and solar resources, and reflect the increase in variable cost at the bulk-system-level associated with renewable integration. These do not represent "integration costs" associated with hosting or interconnection. Other WG members are unclear about the appropriateness of this adder in the LNBA, and whether this was the Commission's intention.

4.2 Bulk System Benefits: Refinements to Existing LNBA Values

Objective

Before being applied in any of the use cases, the LNBA requires refinement of values in the tool. This section identifies proposed refinements to two types of existing values:

- Certain benefits in the LNBA which currently use system level values from DERAC;
- Transmission values, which are included in the tool but for which the current methodology defaults to zero value.

These are values to the bulk system, including transmission benefits, capacity benefits, and CAISO market revenues.

4.2.1 Replace System Values with Local Values

Objective

The current LNBA tool uses system-wide values for certain benefits. This section discusses recommendations to replace those system-wide values with more localized values.

Discussion

The ACR identifies both a primary and a secondary analysis option for Demo B's LNBA methodology. Demo B primarily focused on the transmission and distribution avoided cost component, which is broken down as follows: 1) sub-transmission/substation/feeder level; 2) distribution voltage/power quality; 3) distribution reliability/resiliency; and 4) transmission-level.

While the ACR includes other avoided cost components, Demo B focused on the identified avoided T&D components due to their high variance between specific locations. Other avoided cost components (avoided generation capacity, avoided energy, avoided GHG, avoided RPS, avoided ancillary services) directly use values created under the DERAC tool. The IOUs referred to these components collectively as "system-level avoided costs."

The WG recommended that additional components of avoided costs, which currently employ system-level values, should incorporate additional locational granularity.

Recommendation

Recommendation	**Develop locational specific avoided cost values for energy and capacity**
Consensus?	Consensus
Action type	IOUs to implement modification to tool
Description	Update certain system-wide avoided costs with more locational specific avoided costs. More specifically, locational avoided costs for energy, capacity should be developed using locational information such as CAISO LMPs and local RA data. The Demo B "primary" level of analysis potentially undervalues avoided energy, as LMPs tend to be higher than system average prices owing to congestion and line losses. Also, local resource adequacy values will serve to better capture generation capacity value in constrained areas.

Discussion	**Assess variability in location specific line losses**
Consensus?	Consensus
Action type	WG to analyze further
Description	Line losses downstream from CAISO nodes raise avoided energy cost above system averages; however, in Demo B, IOU-specific average distribution line loss factors were used. Many parties in the WG expressed desire to have the LNBA tool generate line loss reduction information for any DER being deployed at any location in the entire system. The system average line loss adder used currently is not a genuine reflection of the line losses reductions most DERs will create in order for the LNBA tool to be the more accurate, some enhancement of the line loss calculations should occur. The WG acknowledges the need to first address the relative value of this analysis before inclusion into the tool, as the additional value variations that location-specific line losses provide may be very small relative to total project costs. Consequently, the WG proposes that a first step should be to estimate the variability of this parameter across the system to understand the benefits of enhancing the LNBA in this way vs the cost. Within long-term refinement, the WG will aim to determine whether there is enough variability in line losses in specific locations to understand whether line loss variability should be implemented in the LNBA tool.

4.2.2 Avoided Transmission Capital and Operating Expenditures

Objective

This section considers methodological approaches to determining the potential avoided transmission cost that may be achieved through targeted DER deployment.

Discussion

The LNBA methodology as demonstrated in the IOU Demo B projects include multiple location-specific value components building upon DERAC. For avoided transmission capital and operating expenditures, the ACR guidance specifies that the IOUs "shall, to the extent possible, quantify the co-benefit value of ensuring (through targeted, distribution-level DER sourcing) that preferred resources relied upon to meet planning requirements in the CAISO 2015-2016 transmission plan, Section 7.319 materialize as assumed in those locations."

It was concluded that the transmission plan did not identify specific projects that would be required in the absence of preferred resources or associated project costs, or provide information needed to develop DER load reduction requirements. Instead, the LNBA Tool contains a user input for a generic system-wide transmission benefit within Demo B. The value in the field is zero when the LNBA Tool is downloaded, but this does not imply that zero is the correct value or a default value. This is similar to the user input for avoided transmission in, the NEM Successor Tariff public tool (R. 14-07-002). The field was not pre-populated with a value but it was understood that no value should be considered "default," zero or otherwise. However, the WG agrees that the actual value of DERs in avoiding transmission costs is non-zero. For example, system-average marginal transmission costs have been estimated in the past through prior IOU GRCs,20 and distributed solar studies21 22.

The WG is in consensus and has placed high priority for determining a non-zero locational transmission benefit value as a long-term refinement item. To develop this value, the WG will focus on 1) understanding the shortfalls of the transmission system capability associated with the distribution facilities being analyzed; 2) developing a potential methodology for inclusion, 3) testing the functionality of the methodology within the LNBA tool; 4) ensuring that any avoided cost value adopted reflects the ability to actually avoid transmission cost in the near or long-term; and 5) coordinating with and understanding how CAISO's transmission planning process reflects contribution of DERs to avoid or defer actual transmission investment.

[19] https://www.caiso.com/Documents/Draft2015-2016TransmissionPlan.pdf. See pp 333-337 for a complete list of specific locations.
[20] SCE's 2011 recent GRC (A. 11-06-007) shows a marginal cost for CAISO-controlled transmission of $59.18 per kW-year (2012 $). See A.11-06-007, SCE Workpapers, "MCCR" sheet, "Input Sheet" tab, cells D17-D19.
[21] See the San Diego Distributed Solar PV Impact Study (Black & Veatch and Clean Power Research for the Energy Policy Initiative Center, University of San Diego School of Law, February 2014) at p. 38, Table 18, which calculated a marginal cost of CAISO transmission for SDG&E of $102.83 per kW-year
[22] August 2015 Vote Solar and SEIA analysis found marginal CAISO transmission costs of $87 per kw-yr.

Recommendation

Recommendation	Form technical sub-group to evaluate potential methodologies for avoided transmission costs
Consensus?	Consensus
Action type	CPUC and CAISO Policy Guidance
Description	As mentioned, the WG places high priority in ensuring that the CAISO TPP evaluates locational avoided transmission costs within its long-term TPP refinement activities. To support the CAISO TPP process, CPUC should seek CAISO approval for direct formation of a CAISO technical sub-group including IOUs, CAISO, and interested parties. Team will evaluate potential solutions that (1) focus on avoided the need for incremental transmission projects (i.e., not including existing projects or existing transmission revenue requirement) and (2) identifies the extent to which DERs in certain locations can avoid the need for such future projects. This subgroup will also consider whether transmission value can be captured through a location-specific value, system-level value, or through both a system-level value and at a locational-specific-level value. This envisioned subgroup would report findings back to CAISO and the broader LNBA WG.

The following are suggested starting points and considerations for methodology development. The WG has not yet held substantive discussions on this topic as a group, but provide additional detail on each of these discussion points.

- The broader cost-effectiveness framework may include a system-wide transmission value. Reducing transmission load provides both system-level, as well as location-specific benefits. Additionally, incorporating a reasonable proxy value in the interim as location-specific values are developed may be useful. The WG agrees that a proposed system-wide value must reflect actual avoided costs to ratepayers.
- One proposed place to begin analysis is to base avoided transmission cost on CAISO transmission revenue requirement allocated by CAISO coincident peak and/or specific location.
- Marginal CAISO transmission costs can be calculated based on a regression of the CAISO base transmission revenue requirement (TRR) as a function of CAISO coincident peak in the same period. This regression can use both historical and forecasted TRR data as a function of coincident peak demand, similar to the regressions that have long been used to calculate marginal distribution costs in CPUC ratemaking. While TRR data can differentiate between “reliability”, “economic” and “policy-driven” CAISO transmissions designed to access renewable resources, DER deployment can reduce transmission investment in all three categories. Consider allocating the transmission revenue requirement socialized across the system only to the specific line segments identified.

- The proposed methodology using CAISO's transmission revenue requirement does not represent the marginal transmission cost nor location specific transmission project deferral value. Transmission revenue requirement represents the costs of transmission already built. DERs cannot defer projects that have already been built; this approach would be crediting DERs with value they simply do not provide.
- Focusing on low-voltage networks and/or transmission constrained areas may provide a good starting point. Focusing on the low-voltage transmission network and transmission constrained areas would provide greater transmission avoided cost. Limiting scope to specific sub networks will limit variables and potentially make generating the load reduction criteria easier to calculate. However, an ideal methodology would account for all transmission projects and transmission-level costs. It may be worth discussion of whether non-deferral benefits may be added to the avoided transmission cost methodology. These may include the value of providing frequency response, frequency stability, and other services. However, many WG members also indicate a need to focus the methodology on attributing real avoided cost values to DERs where they avoid or defer cost to ratepayers.
- It is maybe useful to develop or enhance existing software to be able to run a power flow analysis that can determine what series of load reductions could defer transmission projects, in collaboration with CAISO. Developing a methodology similar to the one created for distribution deferral calculations will make the LNBA easier to interpret for DER developers and utility planners alike. Ideally the automated tool will be able to run thousands of DER scenarios to generate the most optimal set of load reductions at specific substations to defer transmission projects. If such a tool was developed the IOUs/CAISO could say with certainty that DERs installed at a specific location will achieve a hard dollar amount of deferral savings. These load reductions and transmission deferral values could be added as an additional LNBA layer in each of the IOU heat maps. Long-Term Discussion and Potential Refinements on LNBA Methodology

5 Long-Term Discussion and Refinements on LNBA Methodology

Per the ACR, one of the purposes of the WG is to continue to improve and refine the LNBA methodology. This longer-term work related to ongoing refinements to LNBA methodology may be conducted in parallel to Demonstration B, though not directly related.

These discussion items are related to expansion of analytical scope past that considered in Demo B, additional benefits for inclusion, additional means of valuing DERs, and how uncertainty within the distribution planning process may be captured. Given the diverse group of stakeholders that make up the LNBA WG, it is understood that a vast majority of these items do not have consensus. Considerations of their potential inclusion require additional guidance from the Commission regarding any potential future use of the LNBA methodology past the uses identified in Section 3.2.1.

Final discussion on these items, given their ongoing nature, will be included in the Final Report on Long-Term LNBA Refinement, as identified within the ACR. As the WG has had some discussion on these topics in parallel with the development of Demo B, they are summarized in the following sections.

This section of the report contains discussions and recommendations relating to modification and refinement of the LNBA methodology.

5.1 Consideration of Locational Benefits Beyond Those Identified in the Distribution Planning Process

5.1.1 Accounting for Uncertainty in the Distribution Planning Process

Objective

This section discusses the following potential refinements: improve the comprehensiveness and accuracy of the distribution capacity component of LNBA by capturing the effects of forecast error on planned distribution upgrades; capacity additions currently planned for future years may be cancelled as the plans are refined due to lack of need; and locations with no current planned capacity addition may require such an upgrade as distribution plans are refined due to an unforeseen need. In addition, values may need to be defined for needs that fall beyond the 10-year planning horizon of the utilities.

Discussion

The LNBA tool is based upon the distribution planning process. The forecasts underlying the planning analyses are by definition uncertain. Due to changing forecasts, it is possible that new projects may become necessary, adding to the value of DERs in that location. It is similarly possible that current projects may become unnecessary, reducing the value of DERs in that location. Furthermore, the current planning forecasts only extend 10 years; there is no analysis beyond the 10-year period though the DERAC provides for T&D benefits out to 30 years. This section considers recommendations to modify the tool to address these sources of uncertainty.

Development of the LNBA methodology requires making certain assumptions and developing scenarios for DER growth and value of DER to determine which planned projects may be deferred by DERs. IOUs' distribution load forecasting methodology, which feeds into the annual distribution planning process, determines growth projections over 10 years. Two different DER growth projections were used in Demo B, per ACR requirements. The IOUs then use peak load information and detailed hourly load profile data to understand load reduction need for future planned projects under each DER scenario. The WG recommends the following refinements to better incorporate uncertainty and inform decision making:

Recommendations

Discussion	**Examine methods to reduce uncertainty in planning and utility investment**
Consensus?	Non-consensus
Action type	WG to analyze further
Description	The LNBA working group should examine ways to reduce uncertainty in distribution and transmission planning, which primarily stems from forecast uncertainty.

Supporting Arguments	DER deployment can defer needs that may have otherwise materialized. Alternatively, identified needs that may have spurred DER sourcing for deferral can ultimately not materialize due to forecast error.
Opposing Arguments	Out of scope – load forecasting and DER scenario development are not part of LNBA, though they drive the distribution planning outputs used in LNBA. Forecasting topics are discussed in DRP Track 3.

Discussion	**Incorporate an uncertainty metric in the LNBA tool (for planned deferrable projects)**
Consensus?	Non-consensus
Action type	WG to analyze further
Description	The deferrable distribution upgrades which form the basis for distribution benefits in LNBA are uncertain. Upgrade projects planned for future years in one planning cycle may not be ultimately implemented because future planning cycles with updated load forecasts show a reduced need. When such forecasted projects are assumed to be deferrable and hence provide an opportunity for DERs to capture the associated benefit, the quantification of that benefit should not assume that the project is 100% certain. An uncertainty metric for future projects would increase the accuracy of quantification of T&D benefits in LNBA. The heat map should indicate not just the relative dollar amount of potentially deferrable investment but also the certainty of investment. Projects with the highest certainty (as informed by the deferral framework criteria) *and* dollar amount may be prioritized for DER deferral. The forecast in and of itself is somewhat uncertain and has some inherent error. This topic should be coordinated with Track 3 Sub-track 1 on Forecasting and DER Growth Scenarios, focusing on aligning and developing a better planning forecast to assess system constraints. As the forecast continues to be refined, projects should become more certain. However, near term projects will always be more certain than projects identified further in the future.
Opposing argument	Prioritizing deferral opportunities is an issue for the Track 3 deferral framework and is out of scope. This recommendation makes sense only in tandem with the following recommendation as a counterbalance to the inclusion of value for deferring projects that were not foreseen but would have been become necessary.

Discussion	**Develop a methodology to incorporate deferrable projects that may occur unexpectedly (i.e. unplanned projects)**
Consensus?	Non-consensus
Action type	WG to analyze further

Description	As described above, due to forecast uncertainty, planned upgrade projects for future years are uncertain. Because projects toward the later years in a utility's ten-year distribution upgrade plan tend to be less concrete than those in the earlier years, the utilities in Demo B focused on near term projects.[23] Forecast uncertainty also results in new, unanticipated upgrade projects emerging within the forecast horizon in future planning cycles due to updated load forecasts. The IOUs should develop a method to quantify the likelihood of an unplanned project emerging in a location based on forecasted conditions and forecast uncertainty.
Supporting Arguments	The May 2nd Assigned Commissioners Ruling called for "methods for evaluating location-specific benefits over a long-term horizon that matches with the offer duration of the DER project. For example, there may be economic benefits in deferring network augmentations in the far future; however, the benefits are likely to be discounted due to uncertainty. This work should explore whether / how probability estimates, based on the utility's past and current distribution planning experience, could be made that (1) an as-yet undetected need for upgrades will be required during the distribution planning period and (2) procurement of DERs that have a timescale greater than the distribution planning period will avoid future upgrades subsequent to the distribution planning period."[24] In order to properly value DERs, the LNBA must measure the avoidance of upgrades that would have been needed without DER growth but were not planned for ten years or were never proposed in utility distribution plans. Some distribution upgrades are not identified in annual distribution planning. These short lead-time upgrade projects are not considered deferrable by DERs. However, DERs that may not defer a planned upgrade at the time they were installed may actually reduce demands on a feeder and reduce the need for the IOU to perform an unexpected upgrade. LNBA methodology should include the value of DERs in avoiding or reducing the likelihood of unplanned distribution upgrades. In the long-term, DERs may reduce utility loads such that T&D upgrades that would have been required in the absence of DERs never even need to be considered in the utility planning process. Likewise, needs will be identified and projects proposed in the future. However, these needs capture only a portion of the T&D costs that DERs can avoid. Where increasing load growth would otherwise result in triggering future mitigation project planning absent DERs, earlier DER deployment or operation relative to the without-DER case can delay or avoid the need for upgrades. Thus, DERs can avoid more than the projects

[23] For example, six of nine deferral opportunities studied by PG&E are scheduled for 2018, and the three others are planned for 2019, 2020 and 2022.
[24] May 2nd, 2016 Assigned Commissioner's Ruling, p. 36

	identified as deferrable in the current T&D plans. This value should be recognized through long-run marginal transmission and distribution costs, and handled with long-term avoided T&D values that serves as a "baseline" or "background" to which more specific locational deferral values are added. To ignore these long-term avoided T&D costs that never rise to the level of deferrable projects in utility plans would understate the benefits of DERs. In addition to load-driven needs, needs for DER integration will be identified and projects proposed in the future where existing grid capacity reaches saturation. Where increasing customer demand would otherwise result in triggering future mitigation project planning, earlier changes in DER deployment or operation relative to the base case can delay or avoid ever reaching this threshold. This value should be recognized. While less precise than the cost of specific project proposals, areas approaching saturation can be clearly identified based on the rate of growth and existing capacity headroom. Mitigating such projected customer demand has less urgency than in areas where upgrade thresholds have already been crossed, and the value of such mitigation should be proportionately discounted, but should not be ignored. Beyond capacity upgrades, there may be opportunities to use DERs to allow for the downsizing of replacement equipment and thereby avoid larger capital expenditures. For example, if an upstream distribution facility fails and needs to be replaced, then the IOUs' distribution engineers would not necessarily specify replacement equipment with equipment of the same capacity as the failed device. Instead, they would account for DER on the feeder and may result in the replacement facility being smaller and less costly than a "like-for-like" replacement. The Demo B reports do not attempt to quantify such benefits. In future versions of the Tool, there should be proxy value that reflect the potential benefits of DERs avoiding these unexpected upgrades or allowing for the installation of less costly equipment in the event of an unexpected equipment failure. Finally, LNBA inputs and methodology must be refined to account for projects which materialize between planning cycles.
Opposing Arguments	Quantifying avoided costs as described above are purely speculative as projects in those scenarios were never developed. The planning forecast is made up of both DER and load, both of which change for each year the forecast is developed. To determine if projects under the scenarios explained above were avoided by decreasing load or higher DER requires a comparison of multiple years of forecast and recorded data, the historical load and DER profiles would then need to be separated to understand how each impacted the ultimate distribution profile. Next, an entire planning analysis would be required for a scenario without DER to determine if the removal of existing DER could have contributed to a new project identified in this "no DER" scenario. These tasks would require a significant increase

	of resource dedication to complete. This recommendation is requesting an avoided cost calculation for projects that were never developed while also establishing if the cause of why these projects were never needed is due to increasing DER or reducing load growth. The incremental cost savings of downsizing any particular piece of equipment are quite modest. Furthermore, given that ultimately load tends to grow, downsizing replacement equipment may actually be adding to the long-term cost, as in the future another replacement may become necessary to upsize the equipment. Utility investments are "lumpy" by their nature. When an equipment replacement is necessary, it generally does not make sense to downsize equipment. In addition, downsizing equipment would then reduce the hosting capacity of that particular distribution equipment. If the scenario arises where DER is then causing the need for more capacity, the smaller distribution equipment would then need to be replaced. This would make the distribution system less robust at accepting both increases in load and DER. At minimum, this benefit would require significant additional study and analysis to ensure that downsizing does in fact increase expected ratepayer benefits.

5.1.2 Incorporation of Additional Values into LNBA

Discussion	**Value locational value of DERs beyond 10 years**
Consensus?	Non-Consensus
Action type	WG to analyze further
Description	System-level avoided costs in the Demo B LNBA tool extend for the life of a DER solution. For distribution benefits, the tool identifies deferrable upgrades needed, forecasting out up to 10 years, in alignment with current IOU distribution planning windows. Calculation of avoided costs should extend to the end of project life. The LNBA tool could use system average values to calculate avoided costs between Year 11, to the end of the project.
Supporting Arguments	The Distributed Energy Resources Avoided Cost calculator includes system wide averages for transmission and distribution values that extend out 30 years. This reflects the fact that, by reducing load, many DERs will have benefits beyond the distribution planning process's 10-year window by avoiding projects that would have otherwise occurred due to load growth.
Opposing Arguments	The LNBA currently includes non-deferral benefits beyond 10 years, and the deferral benefit, when calculated using the Real Economic Carrying Charge (RECC) method, captures the benefit of deferral throughout the life of the deferred asset. The distribution electric system configuration can change significantly over time, any locational distribution benefit beyond the 10-year planning window is highly speculative.

5.2 Distribution Benefits: Analytical Scope and Additional Benefits

Objective

This section discusses recommendations concerning the overall scope of the analysis that determines potential distribution benefits.

The current LNBA scope (as determined in the May 2 ACR) focuses on identifying the potential benefits of DER resources. This section considers recommendations to LNBA scope that go beyond identifying the benefits of DERs. (This section does not include recommendations concerning adding values related to the uncertainty of the planning process; such recommendations are considered in the Uncertainty section.). Additionally, this section includes other recommendations concerning the structure of the analysis.

5.2.1 Analytical Scope

Objective

This section addresses general cross-cutting and cross-cutting recommendations that do not fall into the more specific sections that follow.

Discussion

This section summarizes discussion regarding which DER growth scenarios should be considered, and whether LNBA should include the costs of DER penetration.

Recommendations

Discussion	**Include Cost of DER Penetration**
Consensus?	Non-consensus
Action type	WG to discuss further
Description	The LNBA should take into account the cost of DER penetration using various DER growth scenarios. This should be done first by increasing hosting capacity limits found in the ICA (if necessary) – when a feeder has hit the limit of hosting capacity, it should be investigated which limit has been violated, and how much it would cost ($) to increase the hosting capacity to avoid the violation. It could then be estimated how much the hosting capacity has increased under DER growth scenario (MW) and the cost to do this ($). The cost to integrate various levels of DER could thus be estimated. Additionally, some of these costs may be avoided or deferred by DERs themselves. These could then feed into the LNBA tool. It must be

	determined which violations are deferrable with DER's themselves (e.g. by modifying generation output, with smart inverters, storage, etc.).
Supporting Arguments	This recommendation links the ICA and LNBA tools. It is understood that the capacity to do so currently does not exist, but linking the tools does provide additional value.
Opposing Arguments	The IOUs understand that including the hosting capacity-related costs of incremental DERs would result in a more complete "net" valuation of those DERs; however, we do not current have the capability to estimate the cost of increasing hosting capacity system-wide on a circuit by circuit basis. Specifically, the IOUs do not have an automated capability to estimate the cost of increasing hosting capacity. Right now, this is a manual process that requires individual circuit analysis based on specific proposed projects. This is thus well beyond the scope of either the ICA or LNBA. This would also require performing the complete distribution planning process and DIDF as both processes feed into the LNBA calculation. Accounting for multiple DER growth scenarios will dramatically increase the amount of work not currently able to be performed by the IOUs with existing software tools. Finally, the development and inclusion of a methodology for this value may be outside the scope of the LNBA. The understanding of the WG throughout the development of LNBA is that the cost of DER development is not included in the net benefits analysis. This makes sense in the context of what the LNBA is and what it is not. LNBA is not a tool to make a go/no-go determination whether to build a DER system. Such a determination would include the cost of building the DER system.

Recommendation	**Use Base Growth Scenario Only**
Consensus?	Non-consensus
Action type	WG to analyze further
Description	LNBA methodology should use the base DER forecast to determine value of additional DER, rather than the high growth scenario
Supporting Arguments	The ACR defined two DER growth scenarios – a base DER growth scenario, and a very high DER growth scenario. In some of the IOU Demo B reports, it was determined that the impact of the very high DER growth scenario was not consistent or intuitive. Further, the high growth scenario depends on many policy interventions that cannot be assumed. Methodological choices for the high growth scenario and lessons learned from Demo B should be shared with the Track 3, sub-track 1 of the DRP.
Opposing Arguments	This is potentially a question for Track 3, sub-track 1 on load and DER forecasts or Track 3, sub-track 3 on integration of DRP into planning.

	The appropriateness of any growth forecast depends on the application of the methodology and tool.

5.2.2 Additional Benefits

Objective

In review of the Demo B Final report, the WG engaged in discussion regarding whether the current LNBA implementation under Demo B omits certain benefits provided by DERs. This section considers and summarizes discussion around those additional benefits.

This section does not contemplate the hypothetical additional value through consideration of "not yet identified" deferrable projects. This potential source of value is considered in the Uncertainty section (Section 5.1.1).

Discussion

Over multiple WG meetings, the joint IOUs consulted on and agreed upon electric services that DERS could potentially provide, for the purposes of Demo B. The ACR required the IOUs to consider the full range of electric T&D services that DERs can potentially provide that result in avoided costs. The values must include services associated with distribution grid upgrades identified in 1) the utility distribution planning process, 2) circuit reliability improvement process, and 3) maintenance process. The WG agreed to use the four grid services developed under the IDER Competitive Solicitation Framework (CSF) Working Group: 1) T&D capacity deferral; 2) voltage support; 3) reliability – back-tie services; 4) resiliency (microgrids).

The IOUs, in their final Demo B reports, also included a list of services DERs have the potential to provide, but did not include in Demo B, as well as a list of services DERs cannot currently provide.

Many WG stakeholders, in their final review of Demo B reports, recommended that LNBA also include means of evaluating additional grid services, to the best estimated non-zero value possible based upon a demonstrated methodology for quantification of indicative values if available, and reflecting the degree of uncertainty. The WG engaged in discussion on how and whether to include values to replace a zero-value where an industry-recognized methodology has yet to be established.

The WG also has yet to engage in full discussion, but anticipates to consider whether and how potential benefit categories should be considered. This includes discussion whether LNBA should focus only on benefits that represent actual avoided utility expenses, or whether LNBA should additionally include non-energy benefits. Those who believe that LNBA should only focus on values that directly reduce a utility's revenue requirement believe that only benefits that actually reduce revenue requirement lead to ratepayer savings. Further, societal benefits are largely not local. Understanding who receives these benefits, and how exactly these benefits are accrued, is valuable.

Moving forward, in developing methodology for these proposed values, it is important that the WG define the type of value derived (e.g., avoided utility expenditure) as well as who receives the benefit. Specifically, any value included in the LNBA need to specify whether it represents an "avoided utility

expense" (CapEx or O&M) or some other kind of value, and should indicate the type and who receives the benefits (e.g. societal value, customer value).

This section considers recommendations first for *how* benefits should be considered, and then recommendations for specific benefits.

Recommendations

Discussion	**T&D values to be included in future modifications of LNBA Tool should only reflect grid services adopted from IDER Competitive Solicitations Framework**
Consensus?	Non-consensus
Action type	CPUC Policy Guidance
Description	There are many "potential" values that have been suggested. However, many of these proposed values do not have a clear means of quantification established due insufficient information, insufficient control infrastructure, or lagging regulatory processes. Values should only be included in the LNBA if they have an established, industry-recognized methodology for quantification. "Placeholder" values must not be used, especially if there is debate about whether the value is positive or negative.
Supporting Arguments	The LNBA tool is not designed to speculate on potential sources of value. For potential values that do not have a defined method of quantification, additional research and analysis is necessary to determine whether or not these values actually exist.
Opposing Arguments	Many services are currently represented as providing zero value. Where an industry-recognized methodology has not yet been established the best estimated value (or range of values) should still be used. To assign a value of zero when this value is not supported by any evidence is introducing an inappropriate bias. Further, there is not consensus over what qualifies as an "industry-recognized" methodology. The Commission should consider research on these values to determine their existence and magnitude (e.g., existing peer reviewed research on asset life extension).

Discussion	**Explore asset life extension/reduction**
Consensus?	Non-Consensus
Action type	WG further study required
Description	DERs, by reducing thermal stress on existing distribution equipment, may potentially extend equipment lifetime. Conversely, DERs could shorten an asset's life through additional usage and strain. The impact of DERs on asset life should be explored.

Supporting Arguments	The IOUs identified this potential service in Demo B final reports, and noted that it is currently difficult to accurately quantify this benefit, recommending its further inclusion as a long-term refinement item. Some stakeholders have noted that there is already research demonstrating this value.
Opposing Arguments	Significant effort would need to be undertaken to study asset life extension/reduction. Further, there are significant concerns that a utility would replace aging infrastructure at a certain point regardless of DER deployment, which means DER's would be credited for a value they do not provide. Each DER impacts distribution equipment in different ways, complicating the analysis even further.

Discussion	**Situational awareness or intelligence**
Consensus?	Non-consensus
Action type	WG to study further
Description	This service was identified in the IDER CSF WG Final Report and in Demo B final reports, but not formally defined.
Supporting Arguments	It is expected that IEEE 1547 Smart Inverter standards are going to determine how to enable the data collection abilities of smart inverters. Furthermore, many DERs have metering equipment that can collect data with more granularity, and with lessor latency, than utility equipment. Through aggregators, DERs can provide this data to the utility potentially avoiding utility investments in telemetry and monitoring equipment and improving the utilities' awareness of conditions on the distribution system. Utilities do not have perfect information on grid conditions at all locations at all times. DER systems can provide additional information that is useful in evaluating local conditions. Hawaii provides a good example of this, where DER providers have made data available to utilities that has aided in grid management.
Opposing Arguments	This hypothetical benefit has not been discussed or even clearly defined within the context of the LNBA WG. To date, there is no analysis to provide any sense of the scope or magnitude of additional "situational awareness provided by DERs: there is no indication of the specific information that will be provided to IOUs, there is no indication of the format, quality or frequency of such information, and there is no indication of whether DER providers intend to provide this information freely or expect that IOUs will provided additional payments for this information. More critically, there is no indication of the *usefulness* of this information. How much information is necessary to begin to improve "situational awareness? How many DERs are necessary on a particular circuit in order to provide this level of information? What is the necessary level of reliability of this information?

	Finally, there is no sense of the *value* of this information. Does this information reduce ratepayer expense? How so? If not, do other parties somehow benefit from this information? How? These questions are complicated and challenging. It would be inappropriate for the WG to spend time on this matter.

Discussion	**Increased reliability (non-capacity related):**
Consensus?	Non-consensus
Action type	IOUs to implement change to LNBA
Description	Include benefits associated with increased reliability provided by DERs, e.g. through reducing the frequency, duration or magnitude of customer outages.
Supporting Arguments	The LNBA methodology should value increased reliability and location. For example, if a DER provides reliability service in a location where the cost or value of reliability is above average, to a relatively small set of customers but those customers have a high "value of service", then the value that the specific DER provides could be significant
Opposing Arguments	LNBA currently includes the value of increase reliability from DERs where DERs can defer or avoid an otherwise necessary investment to bring reliability up to an acceptable level. Right now, these are defined as investments providing back-tie capacity (a function which can enable switching operations to reduce the number of customers on outage) or microgrid services (a function which can reduce the frequency and duration of outages for remote customers with an unreliable connection to the grid). If a particular customer or set of customers places a value on reliability above the standard level that is provided, that customer can make investments in DERs to improve their reliability. This should not be a cost that other customers bear through additional incentives for that customer's DER investment.

Discussion	**Evaluate Planned Upgrades Meant to Accommodate Additional DER Growth**
Consensus?	Non-consensus
Action type	WG to analyze further
Description	Any planned upgrades that are due to the need to accommodate additional DERs on the grid, which may be avoided or deferred by DERs, should also be included as a deferrable project.
Supporting Arguments	
Opposing Arguments	Where upgrades are needed to accommodate DERs that increase load (e.g. to serve electric vehicles), such upgrades would be identified in the normal distribution planning process, and would already be considered deferrable in LNBA.

	In cases where upgrades are needed to accommodate DERs that are interconnecting as a wholesale resource, the DER owner/developer would be responsible for that upgrade cost, and should be able to take actions that would reduce that cost in the interconnection process. The remaining upgrades to accommodate DERs might be deferrable by DERs; however, there is not yet an established framework for identifying and planning for those upgrades. Today, these are identified and managed as they emerge. When a planning framework has been established, these upgrades could be considered as deferral opportunities. Wherever possible, a DER that is causing a problem that requires an upgrade should be required to take reasonable actions to mitigate that problem without additional compensation. Utility customers should not provide additional compensation to DER owners/providers to mitigate a problem they are causing and which could be easily mitigated.

Discussion	**Avoiding Maintenance Projects**
Consensus?	Non-consensus
Action type	WG further study required
Description	LNBA methodology should value benefits of DER in reducing the frequency or scope of future maintenance projects.
Supporting Arguments	Maintenance projects are not scheduled far enough in advance for DERs to defer specific maintenance needs. However, by reducing thermal stress, DERs can likely defer maintenance in many cases – this value should be quantified.
Opposing Arguments	There is currently no reliable evidence that DERs actually defer maintenance projects. At minimum, additional data and analysis must be gathered. However, it is quite possible that additional DERs *increase* the need for maintenance projects. In addition, there is no existing method to predict if a piece of distribution equipment will require more or less maintenance during the life expectancy of the DER connected to that piece of distribution equipment.

Discussion	**Downsizing Replacement Equipment**
Consensus?	Non-consensus
Action type	WG further study required
Description	LNBA methodology should value benefits of DER allowing for installation of less costly equipment in the event of an unexpected equipment failure.
Supporting Arguments	Installing DER on a distribution feeder reduces loading on upstream equipment. If an upstream distribution facility fails and needs to be

	replaced, then the IOUs' distribution engineers would not necessarily specify replacement equipment with equipment of the same capacity as the failed device. Instead, they would account for the fact that the DER is on the feeder and may result in the replacement facility being smaller and less costly than a "like-for-like" replacement. Total system load growth has been flat for a decade. Customer self-generation is one reason for that. In the long run, we may need a considerably smaller distribution system. DERs should receive due credit for their contribution to that downsizing.
Opposing Arguments	In theory, this benefit is possible. In reality, this benefit is likely to be small or non-existent: The incremental cost savings of downsizing any particular piece of equipment are quite modest. Furthermore, given that ultimately in the long-term, load tends to grow, downsizing replacement equipment may actually be adding to the long-term cost, as in the future another replacement may become necessary to upsize the equipment. Utility investments are "lumpy" by their nature. When an equipment replacement is necessary, it generally does not make sense to downsize equipment. In addition, downsizing equipment would then reduce the hosting capacity of that particular distribution equipment. If the scenario arises where DER is then causing the need for more capacity, the smaller distribution equipment would then need to be replaced. This would make the distribution system less robust at accepting both increases in load and DER. At minimum, this benefit would require significant additional study and analysis to ensure that downsizing does in fact increase expected ratepayer benefits.

Appendix

a. Parties Participating in the Working Group

The following stakeholder groups attended at least one meeting or webinar of the LNBA WG (parties involved in providing tracked-changes comments in drafting this report are formatted bold underline):

- ABB Group
- Advanced Microgrid Solutions
- Alcantar & Kahl
- AMS
- Artwel Electric
- Bloom Energy
- CAISO
- California Energy Storage Alliance
- California Energy Commission
- **California Public Utilities Commission Energy Division (CPUC-ED)**
- **CPUC Office of Ratepayer Advocates (ORA)**
- **California Solar Energy Industries Association (CALSEIA)**
- City of Burbank
- **Clean Coalition**
- Community Choice Partners
- Community Renewables
- Comverge
- Cross Border Energy
- DNV GL
- ECCO International Inc.
- Energy and Environmental Economics
- Electric Power Research Institute
- Energy Foundation
- Environmental Defense Fund
- Gratisys Consulting
- Greenlining Institute
- Helman Analytics
- ICF International
- Independent Energy Producers Association
- **Independent advocates**
- Independent consultants
- Integral Analytics
- Interstate Renewable Energy Council
- Kevala Analytics
- Lawrence Berkeley National Laboratory
- Lawrence Livermore National Labs
- MRW & Associates
- Natural Resources Defense Council
- Northern California Power Agency
- NextEra Energy
- New Energy Advisors
- Nexant
- Open Access Technology International
- **Pacific Gas and Electric Company (PG&E)**
- PSE Healthy Energy
- Quanta Technology
- Sacramento Municipal Utilities District
- **San Diego Gas and Electric (SDG&E)**
- **Solar Energy Industries Association (SEIA)**
- Siemens
- Smart Electric Power Alliance
- SoCal REN
- SolarCity
- Solar Retina
- **Southern California Edison (SCE)**
- Stem Inc.
- Strategy Integration
- Sunrun
- SunPower
- TerraVerde Renewable Energy
- **The Utility Reform Network (TURN)**
- UC Berkeley
- **Vote Solar**

b. Acronyms

AB: Assembly Bill
ACR: Assigned Commissioner's Ruling
CAISO: California Independent System Operator
CapEx: Capital expenditure
CPUC or PUC: California Public Utilities Commission
CSF: Competitive Solicitation Framework
DAG: Distribution Deferral Advisory Group
DER: Distributed energy resource(s)
DERAC: Distributed Energy Resources Avoided Cost Model
DIDF: Distribution Investment Deferral Framework
DPA: Distribution Planning Area
DRP: Distribution Resources Plan
ED: CPUC Energy Division
GRC: General Rate Case
IDER: Integrated Distributed Energy Resources
IOUs: Investor-Owned Utilities
IRP: Integrated Resource Planning
LNBA: Locational Net Benefit Analysis
NEM: Net Energy Metering
O+M: Operations and maintenance
PG&E: Pacific Gas & Electric
RECC: Real economic carrying charge
SCE: Southern California Edison
SDG&E: San Diego Gas and Electric
T&D: Transmission and distribution
TRR: Transmission revenue requirement
WG: Working Group

c. List of WG meeting Dates and topics covered

Meeting Date	**Topic(s)**
May 12 – 1:00pm-3:00pm Webinar (combined ICA/LNBA)	Opening meeting
June 1- 9:00am-3:00pm In person (combined ICA/LNBA)	First discussion of demonstration implementation plan before June 16th submission
June 9 – 9:00am-3:30pm In person (combined ICA/LNBA WG meeting)	Second discussion of demonstration implementation plan before June 16th submission
July 5 – 2:00pm-4:00pm Conference call (combined ICA/LNBA)	Call to discuss submission of demonstration implementation plan
July 26 – 9:00am-4:00pm In person	Discussion of submitted stakeholder comments on demonstration implementation plans Use cases (focusing on procurement use case) Grid services (6.1.b) E3 methodology Data & maps (6.1.a)
August 31 – 9:00am – 4:15pm In person (combined ICA/LNBA)	Clarification on use cases Initial scoping discussion on long-term refinement issues (6.2.1.(A-D))
September 30 – 9:00am-4:00pm In person (combined ICA/LNBA)	Demo B status update Data access discussion
October 19 - 9am-12:30pm (webinar)	Second scoping discussion on long-term refinement issues (6.2.1.(A-D))
October 27 – 12:30pm-2:30pm (webinar)	Grid services and project deferability criteria for Demo B
November 16 – 9am-12:00pm (webinar)	Review of outline Data (long-term refinement) Review of LNBA tool Avoided transmission cost component
December 13 – 1pm-2pm (webinar)	Status update
January 6 – 9am-4pm In person (combined ICA/LNBA)	Presentation of IOU Demo B reports
January 11 – 1pm-3pm (webinar)	Discussion on planning use case Presentation of LNBA Tool
January 20 – 9am-4pm In person (combined ICA/LNBA)	Discussion on use cases and recommendations
February 22 – 9am-12pm (webinar)	Discussion of WG Recommendations
February 27 -9am-1pm (webinar)	Discussion of WG Recommendations
March 2 – 9am-1pm (webinar)	Discussion of WG Recommendations

d. References

IOU Final Demo B Reports:

1. PG&E:
    - Final Demo B Report: http://drpwg.org/wp-content/uploads/2016/07/R1408013-PGE-Demo-Projects-A-B-Final-Reports.pdf
    - Map: https://www.pge.com/b2b/energysupply/wholesaleelectricsuppliersolicitation/PVRFO/DemoBMap/DemoB.html
2. SCE:
    - http://drpwg.org/wp-content/uploads/2016/07/R1408013-SCE-Demo-Projects-A-B-Final-Reports.pdf
    - DERiM Web Map: http://on.sce.com/derim
    - DERiM Web App – load profiles: http://on.sce.com/derimwebapp
    - Expanded DERiM User Guide: http://on.sce.com/derimguide
    - DRP Demo Results Library: http://on.sce.com/drpdemos
3. SDG&E:
    - Final Demo B Report: http://drpwg.org/wp-content/uploads/2016/07/R.14-08-013-DRP-Demos-A-B-Reports-SDGE.pdf
    - Map: http://www.sdge.com/generation-interconnections/enhanced-integration-capacity-analysis-ica

WG reference materials: All presentation materials, webinar recordings, participant lists, and Party comments on drafts of DRP WG reports can be found online at: http://www.drpwg.org.

CPUC Energy Division Memo on LNBA use cases: http://drpwg.org/wp-content/uploads/2016/07/CPUC-Memo-on-LNBA-Use-Cases-Feb-1-2017-mm7.docx