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 (U901E) 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

INTEGRATION CAPACITY ANALYSIS WORKING GROUP FIRST INTERMEDIATE STATUS REPORT ON LONG-TERM REFINEMENTS

JONATHAN J. NEWLANDER
Attorney for
SAN DIEGO GAS & ELECTRIC COMPANY
8330 Century Park Court, CP32D
San Diego, CA 92101
Phone: 858-654-1652
Fax: 619-699-5027
E-mail: jnewlander@semprautilities.com

ON BEHALF OF ITSELF AND:

CHRISTOPHER WARNER
Attorney for:
PACIFIC GAS AND ELECTRIC COMPANY
77 Beale Street San Francisco, CA 94105
Telephone: (415) 973-6695
Facsimile: (415) 973-0516
E-mail: CJW5@pge.com

MATTHEW DWYER
Attorney for
SOUTHERN CALIFORNIA EDISON COMPANY
2244 Walnut Grove Avenue
Post Office Box 800
Rosemead, California 91770
Telephone: (626) 302-6521
Facsimile: (626) 302-36795
E-mail: Matthew.Dwyer@sce.com

December 22, 2016

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)
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INTEGRATION CAPACITY ANALYSIS WORKING GROUP FIRST INTERMEDIATE STATUS REPORT ON LONG-TERM REFINEMENTS

Pursuant to 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*, dated May 2, 2016, and the *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*, dated August 23, 2016, San Diego Gas & Electric Company (U 902-E), on behalf of itself and Southern California Edison Company (U 338-E) and Pacific Gas and Electric Company (U 39-E), hereby submits the Integration Capacity Analysis Working Group's First Intermediate Status Report on Long-Term Refinements.

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Respectfully submitted,

/s/ Jonathan J. Newlander

Jonathan J. Newlander
Attorney for
SAN DIEGO GAS & ELECTRIC COMPANY
8330 Century Park Court, CP32D
San Diego, CA 92101
Phone: 858-654-1652
Fax: 619-699-5027
E-mail: jnewlander@semprautilities.com

December 22, 2016

ATTACHMENT

INTERIM STATUS REPORT ON LONG-TERM INTEGRATED CAPACITY ANALYSIS (ICA) REFINEMENT

Interim Status Report on Long-Term Integrated Capacity Analysis (ICA) Refinement

Table of Contents

Acronyms

- ACR: Assigned Commissioner Ruling
- CSF: Competitive Solicitation Framework
- CPUC: California Public Utilities Commission
- DRP: Distribution Resources Plan proceeding - 14-08-013
- DER: Distributed energy resource
- DERMS: Distributed energy resources management system
- DLMP: distribution locational marginal prices
- ED: Energy Division
- IDER: Integrated Distributed Energy Resources proceeding

- ICA: Integration capacity analysis
- IOU: investor owned utility
- LNBA: Locational Net Benefits Analysis
- WG: Distribution Resources Plan Working Group
- MTS: More Than Smart

Summary

This interim status report on long-term Integrated Capacity Analysis (ICA) refinement summarizes the discussions of the ICA Working Group (WG) to date on seven topics identified in the May 2nd, 2016 California Public Utility Commission's Distribution Resources Plan (DRP) Assigned Commissioner's Ruling (ACR), as well as long-term methodology refinement topics identified through monthly meetings in relation to Demonstration Project A. ICA WG Discussion's have been facilitated by More than Smart (MTS), and the ICA WG has met at least once per month, starting May 2016. It is expected the ICA WG will maintain this meeting frequency through Q2 2017. Meetings have been in person or via webinar and conference call. The following stakeholder groups attended at least one meeting or webinar of the ICA WG:

- ABB Group
- Advanced Microgrid Solutions
- Alcantar & Kahl
- Artwel Electric
- Bloom Energy
- CAISO
- California Energy Storage Alliance
- California Energy Commission
- California Public Utilities Commission
- CPUC Office of Ratepayer Advocates
- California Solar Energy Industries Association
- City of Burbank
- Clean Coalition
- Community Choice Partners
- Community Environmental Council (Community Renewable Solutions LLC representing)
- Comverge
- 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
- Natural Resources Defense Council
- Northern California Power Agency
- NextEra Energy
- New Energy Advisors
- Nexant
- Open Access Technology International
- Pacific Gas and Electric Company
- PSE Healthy Energy
- Quanta Technology
- Sacramento Municipal Utilities District
- San Diego Gas & Electric
- SEIA
- Shute, Mihaly & Weinberger LLP
- Siemens
- Smart Electric Power Alliance
- SoCal REN
- SolarCity
- Solar Retina
- Southern California Edison

- Stem Inc.
- Strategy Integration
- Sunrun
- SunPower
- The Utility Reform Network
- UC Berkeley
- Vote Solar

Introduction and Background

In accordance with the May 2, 2016 ACR in the DRP proceeding[1] (R-14-08-013), the ICA Working Group was established to monitor and provide consultation to the IOUs on the execution of Demonstration Project A and further refinements to ICA methodology. Energy Division staff has oversight responsibility of the working group, but it is currently managed by the utilities and interested stakeholders on an interim basis. The utilities have jointly engaged More Than Smart for this function. The Energy Division may at its discretion assume direct management of the Working Group or appoint a Working Group manager[2].

The WG serves two main purposes: 1. monitor and Support Demonstration Project A; and 2. Continue to improve and refine the ICA methodology. Longer-term work may be addressed in the final report and may continue beyond the timeframe of Demonstration Project A.

The ACR identifies the following suggested list of long-term refinement activities (ACR 3.2 Pg. A20) on which the Working Group shall consult to the IOUs to continue advancement and improvement of the ICA methodology:

- 3.2.A: Expansion of the ICA to single-phase feeders[3];
- 3.2.B: Ways to make ICA information more user-friendly and easily accessible (data sharing);
- 3.2.C: Interactive ICA maps;
- 3.2.D: Market sensitive information (type and timing of the thermal, reactance, or protection limits associated with the hosting capacity on each line);
- 3.2.E: Method for reflecting the effect of potential load modifying resources on integration capacity;
- 3.2.F: Development of ICA validation plans, describing how ICA results can be independently verified; and
- 3.2.G: Definition of quality assurance and quality control measures, including revision control for various software and databases, especially for customized or “in-house” software.

In addition to the suggested long-term refinement topics, WG members have contributed the following topics as areas of interest for further conversation:

1. Comprehensive ICA and LNBA data access (incorporating 3.2.B and 3.2.D);
    - Automated data analysis
2. Integration into streamlined interconnection;

[1] 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
[2] ACR R-14-08-013 Section 3: “ICA Working Group”.
[3] While the ACR mentions “single phase feeders” the IOUs believe this to mean “single phase line sections” as single phase feeders are not a common place configuration that the CA IOUs have within the system. Work was scoped as such to work on single phase line sections going forward as this is a more predominant asset type that the IOUs have.

3. Integration of the ICA with the growth scenarios in order to inform decision-making;
4. ICA that allows DERs to serve peak load conditions, while maintaining grid stability during low-load conditions.

Further, the WG has already identified needs for refining the ICA methodology, based on discussions with IOUs on the methodology used in Demonstration Project A. It is noted that, due to concurrent timelines, this interim report is written before WG members have read and reviewed the IOU Final Demo A Project Reports, due Dec. 31. Thus, some recommendations for long-term methodology refinement will be adjusted after full review of final demo results (including a response to IOU recommendations related to both initial deployment of ICA to all DPAs and long-term methodology improvements) and incorporated into the Final Working Group Report due January 31, 2017.

In compliance with the ACR, the ICA WG meets at least once a month, sometimes in conjunction with the LNBA Working Group. The schedule and topics of meetings to date is shown below (topics include both short term topics related to the ICA Demonstration Project and long term topics on refinement of ICA):

Meeting Date	Topic(s)
May 12 – 1:00pm-3:00pm Webinar	Opening meeting
May 18 – 10:30am-12:00pm Webinar	Seeking input regarding 1) use of power flow analysis and 2) level of granularity
June 1 - 9:00am-3:00pm In person	First discussion of demonstration implementation plan before June 16th submission
June 9 – 9:00am-3:30pm In person	Second discussion of demonstration implementation plan before June 16th submission
July 5 – 2:00pm-4:00pm Conference call	Call to discuss submission of demonstration implementation plan
July 25 – 9:00am-3:30 pm In person	• Discussion of submitted stakeholder comments on demonstration implementation plan • Use cases • 3.1.c/3.2.c – data and maps • 3.1.b – portfolio analysis
August 31 – 9:00am – 4:15pm In person	• Use cases • 3.1.b – smart inverters • 3.1.f – smart meter/customer load data • Data access
September 30 – 9:00am-4:00pm In person	• 3.1.e – comparative analysis • 3.1.b.i – portfolio analysis • 3.1.d – computational efficiency • Data access
October 17 – 9:00 am-4:00pm In person	• Demo A update • 3.1.d – computational efficiency • 3.1.f – smart inverters • 3.1.e – comparative analysis • 3.1.b.i – DER portfolios • 3.2.a-g – long-term scoping discussion

November 18 – 9:00am-4:00pm In person	• Review of Working Group short term final report outline • Long-term scoping discussion of 3.2.a-g plus other topics • Data
December 13 – webinar	• Review of Working Group interim long-term report topics

Detailed agendas are available within the full meeting summary notes located in the Appendix. The short-term items discussed will be documented in the final ICA WG report, in accordance with the August 23 ACR.

In accordance with the ACR (pg. A19), the Working Group shall be open to the public and informal in nature. To establish general consensus amongst stakeholders during the monthly meetings (both in-person and webinar), More than Smart has asked for a show of hands and/or an audible vote of consensus, with opportunity for WG members who object to the consensus point being raised to do so. WG members are also encouraged to submit comments on all prepared and shared documents, including the meeting summary, stakeholder-submitted comments, stakeholder-submitted scoping documents, IOU demo implementation plans, and other draft documentation.

Given that certain improvements to the ICA could be adopted in a Q1 2017 ICA decision, that IOUs plan to expand ICA analysis to all circuits within their service territories, and that there are multiple CPUC proceedings in parallel to the ICA efforts, the WG recommends prioritizing the ICA long-term items in the following general tier grouping:

Topic	Rationale	ACR
Tier 1: Early to middle Q1 2017:		
ICA and streamlined interconnection	ICA methodology and final recommendations from the ICA Working Group within the final WG report can serve as a key tool for a new Rule 21 proceeding (along with any other interconnection issues to be tackled). Long-term refinements to the ICA methodology focused specifically on the interconnection use case will occur within the ICA WG in parallel.	
Expansion to single phase feeders	Initial discussions should align with streamlined interconnection discussions.	3.2.a
Computational efficiency	Continued evaluation as IOUs consider expansion of ICA to all circuits within service territories.	3.1.d
Comparative analysis	Expansion of comparative analysis to more than one circuit and test more complicated circuits, as IOUs consider expansion of ICA to all circuits within service territories.	3.1.e
Data access	Data discussion focused on understanding IT requirements to address market sensitive information, data sharing, and automated data analysis.	3.2.b, 3.2.d
Interactive maps	Discussion focused on understanding IT requirements and benefits of increasing data directly visualized onto ICA maps.	3.2.c
Tier 2: middle Q1 to early Q2 2017:		

Integration of ICA into growth scenarios for decision making purposes	Refine how growth scenarios are implemented, understand how use cases for growth scenarios may impact ICA results, and make recommendations on incorporation of ICA with growth scenarios. Conversations will occur after February 2017 CPUC workshop on growth scenarios as part of Track 3 efforts.	
Independent validation of ICA	Proceeding in coordination with Track 3 efforts, and following comparative analysis discussion with an agreed-upon dataset and results for parties to compare and validate.	3.2.f
Method for reflecting the effect of potential load modifying resources on integration capacity	Begin development of methodology to include resource reliability and uncertainty factors into ICA, model resource impacts on ICA indicators, assess impacts of load-modifying resources with ICA methodology.	3.2.e
Definition of quality assurance and quality control measures	The WG will determine whether this long-term refinement issue identified in the ACR requires further discussion after reviewing the final Demo A reports	3.2.g
ICA in peak load conditions	Continue discussion of ICA that allows DERs to serve peak load conditions, while maintaining grid stability during low-load conditions	

The WG agreed at the October 17 meeting that these scoping documents, stakeholder comments and meeting discussion notes would form the basis for this report, and that the process for drafting the report would be as follows:

1. Assign WG members to draft initial scoping documents for each of the four identified topics (October 17)
2. Present on initial scoping documents (Nov 18)
3. WG members to review and provide written comment on initial scoping documents (Nov 28)
4. Scoping document authors make edits and revise scoping documents (Dec 1)
5. More than Smart is to circulate a first draft of the report to WG members on Wednesday, Dec 7
6. WG members are asked to make comments by Dec. 12
7. MTS will also provide a second draft by Dec. 13
8. WG members are asked to make a final round of comments by Dec. 15
9. MTS will aim to submit a final draft by Dec. 16

Summary of Progress

As mentioned on Page 3, it is difficult for the WG to assess the overall methodology of the ICA without seeing the results of Demo A. Section 3.2 of the May 2016 Ruling called on the WG to "consult to the IOUs on continued advancement and improvement of the ICA methodology." Part of this work in the January-June 2017 timeframe will include reactions to and lessons learned from the Demo A reports. In addition, the Ruling includes a suggested list of topics for further refinement. The WG has identified the following points on those items.

Topics 3.2.A-G

The following is a summary of discussion to-date on topics 3.2.A-G. The WG first identified which items they would like to further scope, and which ones could potentially be combined with other topics or be addressed after reviewing final Demo A results in December 2016. Due to the timing of the IOU final Demo A report and the interim long-term refinement report, this report will not incorporate those recommendations. Those will be addressed in the final long-term refinement report, due Q2 2017.

The WG parsed out the topics and assigned initial lead authors as follows:

- 3.2.A: Expansion of the ICA to single-phase feeders (Lead author-Roger Salas, SCE);
- 3.2.B: Ways to make ICA information more user-friendly and easily accessible (data sharing) (NO AUTHOR – Decision to merge in data discussion);
- 3.2.C: Interactive ICA maps (NO AUTHOR- WG will review after Demo A results published);
- 3.2.D: Market sensitive information (NO AUTHOR – Decision to merge in data discussion);
- 3.2.E: Method for reflecting the effect of potential load modifying resources on integration capacity (Lead author-Michael Nguyen, SoCal REN);
- 3.2.F: Development of ICA validation plans (Lead author-Andrew Mills & Liang Min, LLNL/LBL).
- 3.2.G: Definition of quality assurance and quality control measures, including revision control for various software and databases, especially for customized or "in-house" software (NO AUTHOR- WG will review after Demo A results published).

Full scoping documents for each topic may be found in the Appendix. WG members were asked to submit comments on the scoping documents, and original authors were asked to make revisions to the scoping documents as appropriate to reflect stakeholder comment and input. The following sections summarize discussions on those scoping documents.

3.2.A: Expansion of the ICA to single-phase feeders

The ICA WG discussed the following questions and statements that provide a framework for further discussion in 2017.

1. After completion of Demo A, IOUs can commence to evaluate the impact of performing single-phase ICA on at least one circuit in each Demo A area. This trial would test the capability of single-phase radials.
2. It is understood that single phase radials are limited in accepting significant additional DER load primarily because of:
    a. The capacity of the single phase wire
    b. Fusing practices where fuses are used to protect the single phase line from system faults
    c. Need to maintain overall system balance
3. WG discussions would consider impact to engineer resources versus the value of the provided data. One potential alternative could be to conduct ICA at the single-phase transformer level rather than at the single-phase node.

3.2.E: Method for reflecting the effect of potential load modifying resources on integration capacity

The ICA WG discussed the following questions and statements that provide a framework for further discussion in 2017.

1. There may be multiple ways to interpret the topic as outlined in the ACR. The inclusion of the word "potential" means that this topic could focus on 1) DER resources not currently dispatched but remain potential load modifying resources, or 2) identified resources based on a specific load forecast. It is recommended that the WG determine whether both interpretations of the ACR are worth further discussion.
2. For identified resources, the WG should assess potential impacts of new and existing load modifying resources on integration capacity based on their impact of historical load profiles on the local distribution grid
3. Not all load modifying resources are distributed resources. The WG focuses its discussion only on distributed load modifying resources. It is recommended that for each load modifying DER included in ICA, appropriate ways to model the resource should be assessed. It is proposed that the most feasible way to incorporate EE/DR into ICA is to net out expected EE/DR impact to the load shapes to assess potential impacts.
4. The WG is interested in refining assumptions on the operational behavior of load-modifying DERs.
5. It may be useful for IOUs or any distribution system operator to perform an assessment of how ICA results can help determine the potential for load-modifying DERs to provide grid services as defined within the IDER proceeding.
6. One discussion the WG has had to date on load modifying resources proposes to reframe the topic as originally written in the ACR ("methodology for reflecting the effect of potential load modifying resources on integration capacity") to reflect instead: "methodology for *quantitative* assessment of the potential *impacts of distributed* load-modifying resources on integration capacity." The proposed quantitative assessment should be readily verifiable, replicable, and scalable.
    a. A majority of WG members believe that the ICA methodology should only focus on grid engineering analysis (e.g., thermal levels, steady state voltage, voltage fluctuation, operational flexibility, and protection limits).
    b. There are WG members who would like to continue discussion on the expansion of methodology to integrate concurrent engineering and non-engineering analyses, such as econometric modeling. This addresses a concern that economic and market benefits of deploying load-modifying resources will not be fully realized if they are not evaluated as methodology inputs. Some WG members think is out of the scope of the ICA scope of work and needs to be discussed in larger planning discussions.
    c. A partial list of recommendations to refine the ICA methodology in support of assessing load modifying resources within the parameters of this discussion topic includes:
        i. Include probabilistic modeling approaches, particularly inclusion of resource reliability/uncertainty variables, explicitly to facilitate modeling of what-if and planning scenarios on the distribution system[4]. Some stakeholders think this is not a near term ICA issue, but should be part of future ICA update discussions.
        ii. The addition of potential load modifying resources may require an ICA methodology based on 8760 hourly profiles (rather than 576 profiles) and

[4] See Page 6 of: EPRI, January 2016, Integration of Hosting Capacity Analysis Into Distribution Planning Tools http://www.epri.com/abstracts/Pages/ProductAbstract.aspx?ProductId=000000003002005793

overall increased granularity to maintain an optimized distribution circuit. It should be noted that 8760 hourly profiles will be much more time and resource intensive than what is currently being done using 576 profiles.

iii. Map specific resource impacts on specific key indicators of ICA, including but not limited to thermal levels, steady state voltage, voltage fluctuation, operational flexibility, and protection limits.

iv. Assess potential impacts of new and existing load modifying resources on integration capacity, based on their impact of historical load profiles on the local distribution grid.

3.2.F: Development of ICA validation plans, describing how ICA results can be independently verified

The ICA WG discussed the following questions and statements that provide a framework for further discussion in 2017.

1. The WG would like to have greater clarity on the inputs and assumptions, and verify the following steps in the ICA: 1) input data, 2) ICA methodology, and 3) ICA tools. The following scoping questions are proposed for each step:
    1) Input data:
        i. How well are capabilities of existing DERs to modify grid conditions reflected in future iterations of ICA? (e.g., does the methodology currently being tested for one circuit assume voltage management functions required by California's smart inverter standards and IEEE 1547?)
        ii. Are any of these steps within the scope of the ICA (or are they bigger issues, best dealt with elsewhere?)
    2) ICA methodology:
        i. How appropriate are the various sub-criteria within each criterion?
            1. Are there additional criteria that might be applied by some experts but not by others based on industry standards and engineering principles?
        ii. How appropriate are the thresholds used for each criterion and the tolerances for excursions?
            1. Is there broad agreement on the thresholds and tolerances?
            2. Do thresholds account for short duration excursions that do not threaten reliability or excursions that can be managed by existing distribution equipment?
        iii. Are the methods/ assumptions transparent?
        iv. Is additional work needed to verify some of the streamlined methods where the iterative method is not available (e.g., voltage flicker)?
            1. Can the streamlined methods be verified with more detailed analysis, either through comparisons to other detailed simulations (e.g. detailed time-series analysis) or to field tests?
        v. How do results compare across ICA methods (EPRI, Sandia, NREL) when tools and data are kept the same?
            1. ICA methods (particularly on criteria and thresholds) are still an active area of research.
        vi. Can the ICA outputs, using the results criteria, be mapped to specific value stacks or distribution services (this links with LNBA work)?
    3) ICA tools:

i. Do parameters or underlying code work without modification on alternate data sets? What are the IT requirements of providing this tool capability? One utility stakeholder says the ICA methodology can be applied anywhere more broadly if the software can support it.

ii. How do results compare across tools (CYME, Synergi, OpenDSS, GridLab-D) when the data and ICA methods are kept the same?

2. Further, the WG would like to discuss levels of uncertainty within the ICA results, given the differences in choice of thresholds across experts. The following scoping questions are proposed:
    1) Is that uncertainty acceptable in terms of repeatability, believability objectives?
    2) Where is there the greatest potential to reduce uncertainty in the ICA results?
3. The WG discussed appropriate data sets that may serve as potential reference points for validation and third-party improvements to the method, and would also like to address time needed for third party analysis and validation. These datasets include
    1) IEEE 123
    2) IEEE 8500
    3) PG&E 12 representative feeders
    4) Others
4. The WG would like to further discuss who would conduct the validation work. It was proposed that the national laboratories, the consulting engineer that is contracted by the Commission for resolving interconnection disputes, and the utilities, among others, may all play a valuable role in validation.
5. The WG discussed whether validating the ICA methodology will only be done for the interconnection use case, or for all use cases. So far, the scoping document discusses only how validation methods may develop for the interconnection use case. Some WG members expressed interest in validation for the planning use case. Additional discussion questions regarding DER growth scenarios would need to be addressed as well.

Other Topics

In addition, the following other topics were proposed by WG members as items of long-term interest:

I. Application Program Interface: John Carney (Pathion);

II. ICA that allows DERs to serve peak load conditions, while maintaining grid stability during low-load conditions: Mark Handschy (SolarRetina) (components integrated into larger discussion on elements to support streamlined interconnection);

III. ICA elements to support streamlined interconnection: Tam Hunt (Communiy Environmental Council), Brandon Smithwood (SEIA), Jim Baak (Vote Solar);

IV. Integration of growth scenarios for decision-making purposes: Sky Stanfield (Interstate Renewable Energy Council, Inc.).

V. These topics followed the same scoping process as those topics identified in the ACR.

VI. Finally, there are remaining topics that did not undergo the same WG scoping process but are of interest for discussion for this WG. Some of these recommendations will be more fully fleshed out in response to the final IOU Demo A report, and included in the final WG report due Jan. 31, 2017. Others were mentioned in the intermediate long-term LNBA refinement report for discussion in 2017. For record-keeping purposes, we list them here as:

VII. Understanding how to integrate the full value stack of DER services into the ICA methodology (largely a LNBA issue);

VIII. Better understanding of how ICA results will be used within the identified use scenarios, as the tool becomes a practical application used within different contexts;

IX. Actively engage to determine how ICA and LNBA may influence each other or be used concurrently;

X. Determine whether the ICA, as an engineering-based tool, can appropriately include non-engineering analysis or factors (ex: to meet environmental goals), as inputs.

I. **Application Program Interface (3.2.b.1)**

The ICA WG discussed the following questions and statements that provide a framework for further discussion in 2017.

1. It is proposed that topic 3.2.b, on making ICA data more user friendly and accessible, is expanded to include means of making data more programmer-friendly to enable an improved automated data analysis.
2. The following next-steps are proposed:
    a. Understand and agree upon a set of use cases to support API access to data.
        i. Specific use cases related to programmer-friendly data sets include: 1) automated site analysis, 2) automated site interconnection application, 3) automated geographic region analysis, and 4) common user friendly tools.
    b. Develop agreed-upon interface and data exchange definitions to support use cases.
        i. The WG is interested in further understanding the downloadable data set accompanying ICA maps, whether it will be available via API, and in what authentication path and format.
        ii. It is proposed that data requests be submitted following specific queries to enable easier automated analysis on a property or set of properties.
    c. Understand which APIs already exist and what efforts can be leveraged.
        i. The WG is interested in identifying opportunities to align data access and data standard issues with the Orange Button Initiative and the Distributed Renewables Generation and Storage (SRGS) Subgroup on Distributed Energy Resources Interconnection Standards.

II. ICA that allows DERs to serve peak load conditions, while maintaining grid stability during low-load conditions (merged into 3 below)

III. ICA elements to support streamlined interconnection

The ICA WG discussed the following questions and statements that provide a framework for further discussion in 2017.

1. There is a need to further understand and evaluate the accuracy or appropriateness of assumptions about load and load shape that underline the hosting capacity calculation.
    - One suggestion with regards to understanding ICA assumptions on load shape was to consider four additional ICA profiles which include occupancy and temperature-driven load patterns: 1) weekday load, “hot” weather conditions; 2) weekday load, “cold” weather conditions; 3) weekend load, “hot” weather conditions; and 5) weekend load, “cold” weather conditions. This would also require discussion regarding data requirements for producing additional profiles and level of effort needed to analyze additional profiles

reasonable given expected results. These considerations should be balanced with considerations of necessary preparation time, computational time and needed engineering resources.

2. The ICA must (per the 2015 Final Guidance ruling, p. 3[5]) be developed with capabilities to support dramatically streamlined interconnection. To achieve this goal, the utilities must provide a visual representation of hosting capacity, and the data underpinning the hosting capacity. As part of Demonstration A the utilities have developed maps. Key discussion questions to consider in refining these visual representations (maps) of the ICA include:
    a. What is the integral/stepwise approach for achieving the goal of streamlined interconnection and does an enhanced map meet the needs of this goal?
    b. Currently the ICA uses a net-generation load curve. With the use of load modifying resources, can utilities' proposed technology-agnostic load/generation profile be refined to accommodate portfolios of DER combinations that are both load and generation? Can a technology agnostic profile be accomplished by using a net-generation/load curve rather than a gross-generation load curve? How would the ICA accommodate project designs for self (i.e., non-export) or "smart" supply?
    c. What is the appropriate frequency at which ICA is updated (real time, near real time, etc.)? Experience with Demonstration A is showing a bi-annual update is expected in the near term.
    d. What is the feasibility and potential timeline of including reliable data on service transformers and secondary conductors? IOU stakeholders believe this could be challenging until they have full secondary information, which will take more time.
    e. Inclusion of single-phase feeders (covered in section 3.2.a) will be considered in the context of a streamlined interconnection process.
    f. What other data, such as the cost of upgrades are needed if a project exceeds hosting capacity, should be included in the ICA maps to help facilitate interconnection? And how would this link with cost data that would assumedly be based in the Rule 21 proceeding?
    g. How can the ICA tool assist in the potential development of full interconnection automation?

IV. Integration of growth scenarios for decision-making purposes

The ICA WG discussed the following questions and statements that provide a framework for further discussion in 2017.

1. If ICA is used to assist with making planning decisions to address future operations and needs of the distribution grid, the WG would like further in-depth discussion regarding methodologies for determining growth scenarios, how growth scenarios are integrated with ICA, and how the ICA results can be used for planning and decision-making processes.
2. Some discussion questions are ICA specific, while others should be discussed in a larger DRP proceeding context. The proposed scoping questions include:

[5] The Final Guidance ruling states: "One integral step in [the process of creating plug-and-play for DER] is the need to dramatically streamline and simplify processes for interconnecting to the distribution grid to create a system where high penetrations of DER can be integrated seamlessly."

a. An evaluation of the results of the ICA analysis with the growth scenarios:
    i. How realistic are the outcomes on a circuit-by-circuit basis?
    ii. Are there modifications to the methodology that would make the results more accurate and useful for planning purposes?
    iii. How should the scenarios be integrated with the ICA for planning purposes? What are the methodological considerations at play?
    iv. Are particular criteria violations (i.e. voltage, thermal, etc.) more or less difficult to accurately predict using the growth scenarios in the ICA?
b. Are the results actionable?
    i. Are they sufficiently accurate and granular to help determine, when used together with the ICA, where upgrades will be needed to accommodate growing DERs?
    ii. How long of a timeframe out can the results be used for decision-making? How frequently would scenario forecasts need to be made to ensure they remain useful?
c. Do the results inform the type of action that can be taken, i.e. whether a wires upgrade or DER solution is possible? Should they?

3. Are there DER growth considerations that are not included in the IEPR scenarios, for example reprogramming of existing inverters for advanced functionality?

4. Data

The ICA and LNBA Working Groups have both identified data access as a key long-term refinement topic. For reporting purposes, the data access efforts of both the ICA and LNBA WGs are addressed in this interim report. The WGs first began working on data access issues at the August meeting. It has been discussed subsequently in the September, October, and November meetings.

In August, the WG agreed that pre-2017 activities would focus on scoping out data access requests by the following questions:

- Stakeholder: Who wants the data?
- Function requiring data: what is the stakeholder trying to accomplish?
- Rationale for function: why does the stakeholder need to perform this function?
- Data types required: what data types are necessary to perform the function?
- Rationale for data type
- Confidentiality issues (ex: customer confidential, sensitive, critical energy infrastructure information (CEII)?)
- Availability of data: is there high cost or high burden to provide this data?
- Alternative data sources (ex: anonymized data, aggregated data, public sources)
- Scope: does this data relate to ICA, LBNA, both, DRP, or other proceeding?

WG members provided input to fill out the spreadsheet with their data requests. The complete spreadsheet can be found in the Appendix.

WG members are interested in taking the following next steps in 2017 with regards to data access:

- Understanding linkages to the general DRP proceeding, including potential overlap with issues to be addressed in Track 3, as well as linkages to other proceedings like the Integrated Distributed Energy Resources (IDER) proceeding
- Understanding data access requests in regards to the identified ICA and LNBA use cases, as well as potentially addressing data in a stepwise approach using the Walk/Jog/Run framework
- Further refining the data access template
- Develop ways to make ICA information more user-friendly and easily accessible (data sharing), including for non engineers (community planners, etc.)
- Understand capacity and means to share market sensitive information (type and timing of the thermal, reactance, or protection limits associated with the hosting capacity on each line);

5. Potential Coordination with U.S. National Laboratories

LBNL, LLNL, and SLAC, as part of a multi-lab team with the Department of Energy Grid Modernization Initiative, presented on a regional demonstration project with applicability to California's DRP efforts. The objective of the "DER Siting and Optimization Tool for California" is to deliver a software platform to promote high penetration levels of DER in California by coupling optimal behind-the-meter investment and operation decision models with Transmission & Distribution co-simulation capabilities, and map sites with high economic potential for microgrid and DER deployment, identify DER adoption patterns taking into account resource coordination (e.g., PV and storage, and combined heat and power solutions), and evaluate impacts of DER penetration on the bulk electric grid.

The project team wants to share the project idea and interim results with the DRP working group and discuss how this software platform could be used to inform different stakeholders on the locational benefits of DER as well as provide additional insights to hosting capacity analysis. It is envisioned that this platform supporting the long term planning efforts by exploring different scenarios of adoption and pointing out challenges and potential solutions as the systems evolve.

A demonstration is proposed by the joint laboratories for Q1 2017. The demonstration could potentially facilitate additional collaboration on:

- Data collection and utilization (short term)
- Big data analytics integration (longer term)
- Exploration of a variety of scenarios/use cases (longer term)

The following discussion questions are posed:

- What is a viable pathway for this new type of technology to benefit the DRP?
- What insight from this project can inform the long-term refinement of the DRP?
    - Interconnection use case:
        - Reflecting potential interactions between the transmission system and distribution system in ICA analysis.
        - ICA dispatch strategies to maximize use of DER without exceeding ICA limits.
        - Combinations of DER to minimize ICA needs.
    - ICA planning use case:
        - Use DER-CAM to identify which customers are likely to adopt DER

        - Develop dispatch profiles and quantity of DER based on customers accessing other value like ancillary services
- What data is needed by the GMLC team to produce CA-specific results?
    - Actual feeder data, time-series of loads at the customer level
- What stage of development should the technology be at to be integrated into the utility processes? Does it need to be a stand-alone, user-friendly software package? This is based on the assumption we should be driving for a standard method that works on any system modeling tool.

Next Steps

In accordance with the ACR, the WG will continue work on the long-term refinement topics and publish its final report on long-term ICA refinements in Q2 2017. A schedule for work has to-date not yet been decided. The WG will define a process for answering the identified discussion items above within the scope of this proceeding and include recommendations and next-steps for these identified long-term refinement topics within the final report.

APPENDIX A: Scoping Documents

These appendices are for consideration in future ICA Working Group discussions and do not represent consensus from the WG for each scoping element.

Data access (see http://drpwg.org/wp-content/uploads/2016/07/Data-access-summary-11.16.16.xlsx

Stakeholder category	**Function requiring data**	**Rationale for function**	**Data types required**	**Rationale for data type**	**Confidentiality issues**	**Availability of data**	**Alternative data sources**
Who wants the data?	What is the stakeholder trying to accomplish?	Why does the stakeholder need to perform this function?	What data types are necessary to perform the function?	Why these data type(s) are required to perform the function?	Ex: customer confidential, market sensitive, critical energy infrastructure information (CEII)	Is there high cost or high burden to provide this data?	Ex: anonymized data, aggregated data, public sources
Developers	Siting for maximum location and temporal value	Maximize locational values to optimize planning and investment decisions	CAISO LMPs or deviation of LMP from zonal Hourly load data at nodal level Data should be downloadable or queryable	Raw hourly data is technology-agnostic	None	No - data exists as part of ongoing utility O&M of local distribution grid networks	Aggregated energy consumption data
Developers	Maximize flexibility and design to optimize mixes of DERs to meet local energy needs of customers	To build a distributed grid, we need to make it easy to constructed customer-sited assets well suited for the host customer	1. Account elements - Account name (ACME Inc. or Joe Smith) - Account address (123 Office St.) - Account ID (2-xxx…) 2. Outage block (A000) 3. Service Elements - Service ID (3-xxx…) - Service address (123 Main ST. #100…) - Service tariff (D-TOU) - Service tariff options (CARE, FERA, etc.) - Service voltage (if relevant) - Service meter number (if any) - # of service meters - a service account may have multiple meters; is that captured? 4. Historical bills (since beginning of service) 5. Billing elements - bill start date - bill end date - bill total charges ($) - bill total kWh	If the customer chooses to have a relationship with a DER provider, the customers wishes should be respected and it should be easy for the provider to perform the needed work on behalf of the customer	The customer's digital signature (including click-through) should be required to authorize data sharing. A third party should nto be held to a higher authentication standard than the utility holds itself. Accordingly, the utility will authenticate using consumer-centric login credentials, for example, zip code and account # or online account username and password. A utility account holder should be allowed to begin and end the clickthrough process on teh third party website. This may happen without any requirement to log in to any other site/process during this flow (e.g. checkbox) or may allow the user to remain in the third party website flow,	No: consistent with prior Commission decisions	

			6. Bill tier breakdown (if any) - Name (over baseline 1%-30%)		even in various authentication scenarios (login, signup, forgotten password, etc.) as in the case of OAuth or open authorization protocols. The click-through process should be designed to be one-click and the third party may lead the custerom request for hte types of data nd the time frame of data sharing. The customer may approve or reject such a request in its sole discretion.		
			7. Bill TOU kWh breakdown (if any) - Name (summer off-peak) - Volume (1234.2) - Cost ($100.23)				
			8. Bill demand breakdown (if any) - Name (summer max demand) - Volume (1234.2) - Cost ($100.23)				
			9. Bill line items (sum should equal bill total charges above) - Charge name (DWR bond charge) - Volume (1234.2) - Unit (kWh) - Rate ($0.032/kWh, if any) - Cost ($100.23, if any)				
			10. NEM/tracked line items - Charge name (E.g., net in/net out) - Volume (1234.2) - Unit (kWh) - Rate ($0.032/kWh, if any) - Cost ($100.23, if any)				
			11. Payment information				
			12. Historical intervals (since beginning of service) - Start (unix timestamp) - Duration (seconds) - Volume (1234.2) - Unit (kWh)				
			Ideally also: capacity reservation level (CRL) for CPP/PDP customers, demand response program name and nomination, if fixed, standby reservation if a customer has on-site generation, and sublap for wholesale nomination				

Developers	Automated analysis of DER solutions	Assess impacts of alternative solutions on grid as means of optimizing solution and preparing data for interconnection request		Reduce costs and expedite interconnection	CEEI - potential risk so can be addressed with allowing access to only authorized recipients. API is best path to secure. Download data creates Broader security risk in protecting replication of data set. There is no customer specific data (other than being able to map an meterID to a geographic location) - actual meter data can be added via existing Green Button process	Most data already exists, but costs are associated with 1) making data available, 2) ensuring security of data, 3) filling missing gaps, 4) setting common formats across IOUs	None
Developers	IOU tools for internal and external access to ICA data (e.g.: PG&E RAM)	providing programmatic access to data, with common formats across IOUs will allow third parties to create tools for the IOUs. This will give the IOU a choice of building their own tools or leveraging a third party who can split their costs across multiple IOUs	Data required in form of API or downloadable/ queryable dataset. + GIS + potentially broader grid data for internal and external tools development incorporating ICA data	IOUs will have option of outsourcing standard tool development (or creating shared source projects) and thus cut internal IT costs	None. This would be tools developed for IOU where IOU set access authorization	No. While there is initial costs to standardize, the long term costs are reduced by leveraging vendors and/or shared source development	Each IOU builds their own tools.
Developers	Meter data access for customers with greater than 250kW demand	For larger customers, meter history data may be moved to a different system and will no longer be available via Green Button APIs	Existing Green Button data formats	in order to (1) reduce costs of individual solar installs, and (2) expedite Interconnection, we need programmatic access to ICA data + same reason to get Green Button data for < 250kw demand sites. DER feasibility, financial modeling, NEM and interconnection impact calculations	Already addressed by the existing Green Button authorization process	Exists	Have larger customers manually download their meter history

Developers	Meter data access by defined geographic region w/ individual customer access per meter - (see confidentiality note for alternative for external to IOU vendor use)	Deeper analysis of given region to not only account for optimal DER site targeting based on grid data but to also incorporate load data (potential localized DER consumption	Data required in form of API or downloadable/queryable dataset. *See "data requests" in companion document	in order to (1) reduce costs of individual solar installs, and (2) expedite Interconnection, we need programmatic access to ICA data - adding meter history data would allow more advanced modeling for target site targeting	CEEI + confidential customer meter history data. Needs discussion as to limiting access to Vendor developed tools that (1) are only accessible by IOU (data used internally); (2) potential non-profit access for studies/reports; (3) potential 3rd party use if can find acceptable method for disclosing higher level data to approved vendors; (4) perhaps IOU only using the data internally to then expose ranked line segments for a given region - where rank values are related to optimal targeting (thus not needing to expose meter data specifically)	Costs associated with (1) bulk fetch of meter history data; (2) security of data; (3) alternative solution for external vendors requires work to perform optimal targeting internal to IOU (potentially via 3rd party developer provided tool) to publish ranked list of line segment related to optimal targeting	Get individual Green Button approvals for all meters in a given geographic region - (not viable)
Developers	Substation Net Load analysis	Assess impacts to substation net load balancing of proposed and planned DER installations. Also a component of geographic region analysis to selecting optimal site targets for DER	Given Substation, provide list of feeders and historical load profiles across feeders As well as indication of connected feeders	in order to (1) reduce costs of individual solar installs, and (2) expedite Interconnection, we need programmatic access to ICA data	CEEI - potential risk so can be addressed with allowing access to only authorized recipients. API is best path to secure. Download data creates Broader security risk in protecting replication of data set. There is no customer specific data	unknown	Alternative could be to sum up all of the demand on a given feeder but this requires then to have individual meter data (a customer privacy concern) for all meters on the feeder. This also does not solve the need to identify connected feeders

Developers	Interconnection	Automation of Interconnection request submittal - standard across ISO - Data in standardized format, potentially additional data related to specific line segment Data may improve workflow automation associated with interconnection process	Data related to status of interconnection approval status: submitted, pending, awaiting particular response/data, complete, etc.	in order to (1) reduce costs of individual solar installs, and (2) expedite Interconnection	Some confidentiality of data between IOU and developer *Many cities make permit process public	Costs to support API interface, work flow engine integration, associated security	Manual entry form, interconnection status tracking
Developers	Provide end customers with accurate project economics, including bill savings	In the sales process, DER providers estimate the economics for the customer relative to traditional utility service. Since rates are increasingly complex (TOU, demand charges, nonbypassable charges, etc.), it becomes impossible for DER providers to accurately model ALL rates for ALL utilities across the U.S.	All details of Commission-approved rates should be published in a central location (i.e. NREL's Utility Rate Database) and kept up to date by each utility.	Rate information can be obtained from the PDFs of Commission-approved schedules, but it is extremely difficult for a human to reproduce a bill from this PDF. A machine-readable, standardized format solves this problem.	None - rates are already public.	Small, since IOU billing systems already have rate information. It just needs to be published consistently and kept up to date by each IOU.	Each DER has to manually parse each utility's rates (50,000+ across the U.S.)
Developers	Develop a more complete understanding of distribution system capacity and limitations (understanding of hosting capacity)	With additional information, developers could: - Better understand upgrade costs and timelines - Develop improved interconnection strategies - Understand the cost of achieving DER capacity for grid services - Optimize a	**Circuit Models** GIS or distribution analysis software model; line equipment; length of lines; latitude and longitude coordinates	These data are necessary for basic distribution system modeling		Circuit models are typically available in utility databases in standardized format	N/A
Developers			**Equipment Thermal Ratings** Thermal equipment ratings for conductor and line equipment by location (Switches, breakers, transformers, voltage regulating equipment, voltage protection equipment, etc.)	These data are necessary to understand the limitations of the system.	Most of this data is already provided in the pre-application report.	Most of this data is already provided in the pre-application report.	N/A

Developers		DER grid service solution	**Voltage regulating equipment** Ratings of voltage regulating equipment by location; voltage equipment settings (unique or typical settings), including bidirectional capacity				
			Protection equipment Ratings of protection equipment by location; protection equipment settings (unique or typical settings)				
			Loading MW load; VARs; Amps; Volts Locations: substation, feeder node, line section, downstream line recloser Updated data made available monthly, historical data made available ongoing, 15 minute granularity	DERs are capable of influencing/supporting the load, VARs, amps and volts. Each of these values are evaluated during the interconnection process and therefore can be useful for the developer.	As data will be aggregated to the node, line section etc., no customer specific data would need to be shared.	This data is already being used to calculate the ICA category limitations.	If load data can't be provided, data to allow developers to estimate load could also be provided. This includes: Number of customers by rate type; customer type: i.e. residential, commercial, industrial; agricultural; household income levels; number of demand response (DR) customers; DR device types; DR event participation statistics. Location by: substation, feeder, node, line section, downstream Line Recloser (SCADA switch)

Developers			**Existing DER capacity** Existing total downstream DER by kW and by type (solar certified and non-certified inverters, machine-based, etc.) Location by: node, line section, line recloser (SCADA switch)	These data are necessary for accurate modeling of the system.	As data will be aggregated to the node, line section etc., no customer specific data would need to be shared.	Downstream generation is already used in some of the limitation calculations.	N/A
Developers	Ensure each individual project planned by utility is accounted for and readily identifiable	Allow third parties to consider and communicate alternative solutions	Individual identifying name or serial number for each planned investment project			Data for major projects are individually discussed within each utility GRC; numerous smaller projects are often summarized under one listing or heading	
Developers	Understand the geographic scope of the area of need	Allow third parties to evaluate the potential for deployment of alternative solutions	GPS coordinates, city, zip code, and electrical configuration (node location by: substation, feeder, node, line section, downstream Line Recloser (SCADA switch)	Specific geographic location and location on the distribution system is necessary for designing a DER solution		Data is periodically delivered to CPUC to support avoided cost analysis and GRCs, but data is presented at district level. Data is not made available by node location (i.e. circuit/substati on)	

Developers	Understand the technical requirements of an alternative solution	Assess whether DERs can be deployed to defer investments	**Deployment Timeline** Planned start of project depoyment (e.g., start of installment of equipment), planned start of project operation, and required start of project to meet identified grid need **Planned asset life** Expected operating life of planned investment **Primary grid need served** Grid need or needs that have been identified as the underlying requirement for the planned project: capacity, power quality (VARs, voltage regulation), frequency regulation, reliability, resiliency, other (specified) **Secondary grid need served** Grid need or needs that are not required or motivating the planned project, but which are valuable secondary impacts or benefits the planned project could provide: capacity, power quality	An understanding of the planned traditional investment is necessary to evaluate alternate solutions.		Data is periodically delivered to CPUC to support avoided cost analysis, GRCs, and solicitations but detailed assessments of primary grid need are not made available for all planned projects This information is generated by the distribution system planning process	
Developers	Understand the performance requirements of an alternative solution	Assess whether DERs can be deployed to defer investments	**Performance requirement of alternative solution** Planned required operation of the project including: operation window (e.g. 24/7, HE 7 - HE 20, summer afternoon hours, etc.), operation duration (e.g. 24 hours, 2 hours, 5 minutes, etc.), required response time following trigger (e.g. 24 hours, 2 hours, 4 seconds, etc.)				
Developers	Identify locations where DERs can be deployed to offset **capacity project** investment	Targeting deployment of DERs to areas of maximum value	**Capacity project** details planned w/in 10 years; MW capacity; node location;	Knowledge of the planned projects is necessary to consider alternatives	IOUs maintain planned capacity projects by location as part of their periodic distribution investment planning process.		

Developers	Assess when DER and load growth will surpass integrated capacity; compare timing against planned projects	Proactively identify areas of particular value for DERs	DER growth forecast MW; load growth forecast MW; integrated DER MW capacity; node location;			Load growth data is readily available but DER growth and hosting capacity analyses are largely new analyses.	
Developers	Identify locations where DERs can be deployed to offset **voltage and power quality project** investment	Targeting deployment of DERs to areas of maximum value	**Voltage and power quality** project details planned w/in 10 years; voltage and power quality results expected; node location;	Knowledge of the planned projects is necessary to consider alternatives		IOUs maintain planned voltage and power quality project as part of their periodic distribution investment planning process.	
Developers	Identify areas with potential voltage and power quality issues	Proactively identify areas of particular value for DERs	**Observed violation statistics** SCADA voltage violation data; i.e., overvoltage, undervoltage, voltage flicker, voltage imbalance, etc.p violation time stamp; violation remedy; node location; **Customer complaints** Complaint type; complaint time stamp; violation verification; violation type; remedy; node location	Locations where voltage support is valuable cannot be identified without this type of information		IOUs have access to power quality violation data which are monitored by power quality engineering groups within distribution operations	System-level statistics are available, but not locational information.
Developers	Identify locations where DERs can be deployed to offset **reliability/ resiliency/ security** investment	Targeting deployment of DERs to areas of maximum value	Project details; node location;	Knowledge of the planned projects is necessary to consider alternatives		IOUs maintain reliability and resiliency projects as part of their periodic distribution investment planning process.	

	Identify areas with potential reliability, resiliency, and security issues	Proactively identify areas of particular value for DERs	**Reliability statistics *excluding* and *including* major events** Reliability statistics: CAIDI, SAIDI, SAIFI, CESO, DEMI; worst performing circuits; major event days; automated restoration operation; **Existing supply redundancy level** Redundancy MW capacity; # of supply feeds (use as proxy for resiliency); node location; **Probability of major event** Probability of major event by geographic area; node location;	Locations where DER services are valuable cannot be identified without this type of information		Reliability statistics are tracked in an Outage Management System Data to calculate redundancy level is available Emergency management and risk operations quantify risks of major events	

3.2.b.(1): Automated data analysis

John Carney (Pathion)

This document describes data related to a potential new additional long term refinement target of 3.2 (B+) "***Ways to make ICA information more programmer-friendly and accessible (automated data analysis)***" – where existing 3.2 is "*Ways to make ICA information more user-friendly and easily accessible (data sharing)*", from MTS ICA Working Group Meeting slide deck (slide 26), dated October 17th , 2016. This document discusses both access to ICA data as well as to related data such as Interconnection standards.

Further discussion should include evaluation of opportunity to align with Orange Button initiative. In particular, but not exclusive to, the working group on Distributed Renewables Generation and Storage (DRGS) – Subgroup F: Distributed Energy Resources Interconnection Standards (DER-IS). The DRGS-DER-IS objectives includes "develop recommendations for Standards Setting Organizations (SSOs) to ensure timely development of interoperable DER interconnection standards meeting industry needs.

Disclaimer: This document should be read as a discussion as to what data makes sense to share, and with whom it makes sense to share that data. In some cases, parts of the data could be used only internal to IOU where the IOU then presents calculated results in order to protect customer confidentiality. In some cases, it may make sense to only expose the data formats and sample data so that 3rd parties can develop solutions for IOUs (or IOUs can develop solutions based on shared source code projects) and thus reduce individual IOU costs for developing bespoke solutions. Some of the later data requirements are not specific to ICA but are related to the use of ICA data in activities that accelerate, and reduce costs for, DER deployments.

Use Case Examples

Uses for data related to grid feeder asset, grid DER data, and grid feeder segment volatility

- Automated Site Analysis
    - Given Meter ID – Retrieve feeder segment data
        - Asset Info, DER Capacity, GIS or polyline, Substation info
    - Given Feeder Segment data – evaluate site feasibility for storage/solar
- Automated Site Interconnection Application
    - Application, application workflow, and application tracking
- Automated Geographic Region Analysis
    - Given geographic region, fetch grid Asset/DER data to support calculation of optimal DER locations – possibly then combining with other data such as weather, LIDAR (roof/parking/land), etc.
    - Can one query data on need for frequency regulation and voltage/reactive power support for a given segment? This would enable better DER site targeting to support grid needs
- Common "User Friendly" Tools
    - Standardization at the data layer instead of (*or in addition to*) standardization at the visual MAP/UI layer
    - Use APIs to create common source development, or enable vendors to create tools for, the 'user friendly' data access needs.

Topic Scope – Subgroup

- **Agreement on Use Cases** to support API access to data
    - **Supported Activities**: Internal utility use cases; utility partner use cases; ISO use cases
    - **Define Goals**: Expedite DER where it can provide the most value to the grid: 1) deferring distribution & transmission costs; 2) grid balancing services – power, voltage, frequency
    - **Define Benefits**: DER optimization to achieve the highest value to the grid and customers; streamlined and lower cost interconnection; lowered overall costs to integrate DER for Utilities, Developers, CAISO, Communities
- **Interface and data exchange definitions** to support use cases
    - **Security/Authentication** required for each interface/data access - e.g. Utility only, DER Developer, Customer approval required , etc.
    - **Publishing format**: API or downloadable data on some frequency?
- What already exists?
    - **API**: API/Data already defined?
        - e.g. ICA Super Outline 3.1.c Map data "downloadable file"
    - **Methods/Expertise**: Ability to leverage Green Button and/or Orange button in terms of defined authentication and API models, and/or in terms of actual working group efforts and expertise - e.g. Orange Button's Distributed Renewables Generation and Storage (DRGS) – Subgroup F: Distributed Energy Resources Interconnection Standards (DER-IS)

Table of ICA Data Items related to Automated Data Analysis

Stakeholder Category	Function Requiring Data	Rationale for function	Data Types Required	Rationale for Data Type	Confidentiality Issues	Availability of Data	Alternative Data Sources
Who wants the data?	What is the stakeholder trying to accomplish?	Why does the stakeholder need to perform this function?	What data Types are necessary to perform the function?	Why these data type(s) are required to perform the function?	For example: Customer confidential. Market Sensitive, CEEI	Is there high cost to providing this data?	For example, anonymized data, aggregated data, public sources?
Software Developer (DER Developer)	Automated analysis of DER solutions for given property.	Assess impacts of alternative solutions on grid as means of optimizing the solution and preparing data for Interconnection request	Data required in form of API or downloadable/ query-able dataset. See "data requests" in companion document	in order to (1) reduce costs of individual solar installs, and (2) expedite Interconnection, we need programmatic access to ICA data	Potential risk so can be addressed with allowing access to only authorized recipients. API is best path to secure. Download data creates Broader security risk in protecting replication of data set. There is no customer specific data (other than being able to map an meterID to a geographic location) - actual meter data can be added via existing Green Button process	Most data already exists. Costs are associated with (1) making data available; (2) ensuring security of data; (3) filling missing gaps in data; (4) setting common formats across IOUs	Manually fetch data through IOU graphical tools . Graphical tools are important, but don't address scale and cost reduction for DER deployments
Software Developer (Vendor to IOU, DER Developer)	Automated analysis of geographic region to identify optimal targets for DER	Assess geographic areas to identify optimal target locations will (1) accelerate the deployment of DER and (2) allow DER development to focus on areas most beneficial to the grid/IOU	same as above	same as above	same as above	same as above	None? - Graphical tools do not support area analysis.
Software Developer (Vendor to IOU)	IOU Tools for internal and external access to ICA data (e.g. PGE&E RAM)	providing programmatic access to data, with common formats across IOUs will allow third parties to create tools for the IOUs. This will give the IOU a choice of building their own tools or leveraging a third party who can split their costs across multiple IOUs	same as above + GIS + potentially broader grid data for internal and external tools development incorporating ICA data	IOUs will have option of outsourcing standard tool development (or creating shared source projects) and thus cut internal IT costs.	None. This would be tools developed for IOU where IOU set access authorization	No. While there is initial costs to standardize, the long term costs are reduced by leveraging vendors and/or shared source development	Each IOU builds their own tools.
Software Developer (DER Developer or vendor to DER Developer)	Meter data access for customer with demand greater than 250kw * not clear if this is an issue across all IOUs	meter data access exists via Green Button; however, for larger customers it seems that the meter history data may be move to different system and thus not available through Green Button APIs	existing Green Button data formats	in order to (1) reduce costs of individual solar installs, and (2) expedite Interconnection, we need programmatic access to ICA data + same reason to get Green Button data for < 250kw demand sites. DER feasibility, financial modeling, NEM and interconnection impact calculations	Already addressed by the existing Green Button authorization process	No. Data exists. Just seems to be unavailable for larger customers	Have larger customers manually download their meter history
Software Developer(Vendor to IOU, Non-Profit) Potentially also DER Developer and/or Vendor to DER Developer	Meter data access by defined geographic region w/ individual customer access per meter - (see confidentiality note for alternative for external to IOU vendor use)	Deeper analysis of given region to not only account for optimal DER site targeting based on grid data but to also incorporate load data (potential localized DER consumption	Data required in form of API or downloadable/q ueryable dataset. See "data requests" in companion document	in order to (1) reduce costs of individual solar installs, and (2) expedite Interconnection, we need programmatic access to ICA data - adding meter history data would allow more advanced modeling for target site targeting	Confidential customer meter history data. Needs discussion as to limiting access to Vendor developed tools that (1) are only accessible by IOU (data used internally); (2) potential non-profit access for studies/reports; (3) potential 3rd party use if can find acceptable method for disclosing higher level data to approved vendors; (4) perhaps IOU only using the data internally to then expose ranked line segments for a given region - where rank values are related to optimal targeting (thus not needing to expose meter data specifically)	Costs associated with (1) bulk fetch of meter history data; (2) security of data; (3) alternative solution for external vendors requires work to perform optimal targeting internal to IOU (potentially via 3rd party developer provided tool) to publish ranked list of line segment related to optimal targeting	Get individual Green Button approval for all meters in a given geographic region - (not viable)
Software Developer (Vendor to IOU, Non-Profit) Potentially also DER Developer and/or Vendor to DER Developer	Substation Net Load analysis	Assess impacts to substation net load balancing of proposed and planned DER installations. Also a component of geographic region analysis to selecting optimal site targets for DER.	Given Substation, provide list of feeders and historical load profiles across feeders As well as indication of connected feeders	in order to (1) reduce costs of individual solar installs, and (2) expedite Interconnection, we need programmatic access to ICA data	Potential risk so can be addressed with allowing access to only authorized recipients. API is best path to secure. Download data creates Broader security risk in protecting replication of data set. There is no customer specific data.	unknown	Alternative could be to sum up all of the demand on a given feeder but this requires then to have individual meter data (a customer privacy concern) for all meters on the feeder. This also does not solve the need to identify connected feeders

3.2.e: Method for Reflecting the Effect of Potential Load-Modifying Resources on Integration Capacity

Michael Nguyen (SoCal Ren)

Proposed Scope

Per the ICA Working Group meeting on October-17-2016, the group seeks to provide input to the IOUs on continued advancement and improvement of the ICA methodology. One of the topics suggested for the ICA long-term refinement is the "***method for reflecting the effect of potential load-modifying resources on integration capacity***," a systematic process for understanding how load-modifying resources could potentially affect the integration capacity.

This paper recommends the following enhancements to the ICA methodology:

- ***Topic Clarification*** – We propose that the topic be more specific by reframing it as a "*methodology for quantitative assessment of the potential impacts of distributed load-modifying resources on integration capacity*";
  - Load-modifying resources could include centralized resources and distributed resources. This topic should focus on distributed resources, which is the emphasis of the DRP and IDER proceedings;
  - Secondly, we propose that this methodology should aim to provide quantitative assessments, which could be more readily verifiable, replicable and scalable. These three qualities are essential in critical assessments needed in strategic decision-making on distributed resource planning.

- ***Integration Capacity*** – We propose the scope of the ICA be expanded to ***integrate concurrent*** engineering and non-engineering analysis that must be intrinsically linked in the modeling of local distribution system capacity needed for delivering high-quality energy services (i.e. safe, reliable, affordable, and in accordance with environmental goals). In another word, the results from the integration capacity analysis must provide integrated grid engineering as well as non-grid engineering analysis (e.g. econometric, environmental impacts, etc.) in order to present completed and cohesive scenario outcomes for effective and meaningful evaluation by the stakeholders.

  Currently, the ICA methodology appears to be narrowly focused on the technical capacity of a local distribution network for hosting distributed energy resources (DERs), which are essentially limited to electrical engineering analysis of the grid thermal, power quality, protection, and reliability. This current ICA approach seems to divorce grid engineering analysis from critical non-engineering assessment, such as econometric modeling of how the goods (i.e., energy) and services (e.g., ancillary, reliability) that DERs might be incented to enhance local system integration capacity. Without seamless integration of engineering and non-engineering modeling in integration capacity analysis, the IOUs and market actors might have less visibility, be less effective in collaborating and driving innovative and comprehensive solutions to support the critical role of the distribution system in delivering high-quality energy services to the customers.

The longer-term ICA refinements must include the assessment of the technical and economic potential for DERs to provide grid services and products. The assessments would require the IOUs, or any distribution system operator to host DERs within a regulatory compact to deliver safe, reliable, affordable and sustainable power to demonstrate: (a) that it understands the technical and economic potential for DERs within the relevant service territory/planning areas, and (b) that is has undertaken all practicable efforts to ensure that cost-effective DERs are optimized cost-effectively. This means that IOUs must make full use of the cost-effective DER capabilities because it is a top-of-the-loading-order, least-cost means of meeting DRP goals for DER optimization and, simultaneously, state environmental performance, such as those in the Integrated Resources Planning proceeding initiated in response to SB 350.

Additionally, the current ICA methodology is based on historic recorded load profiles for each circuit, including the way any existing DER has been operating. This approach does not reflect the how integration capacity could be modified by changing the operation of the already deployed DERs. The proposal to address this limitation is described in the Methodology section below.

- ***Load Modifying Resources*** – We propose that all DERs (i.e. energy efficiency, demand response, distributed generation and storage, EV, and other demand-side resources) be classified as load-modifying (LM) resources. These LM resources could exert positive or negative impacts on the integration capacity of a local distribution system. It is critical on how different LM resources are modeled. For examples, load can easily be modeled by adding load, and generators can be modeled by adding generators. EE and DR take load away but can't be considered the same way as generators given they impact the system differently. The most feasible way to incorporate EE/DR into ICA is to net out the expected EE/DR impact to the load shapes to assess potential impacts.

  We recognize the challenges in predicting accurately the impacts of DERs on integration capacity due to the uncertainty of distributed resources that are not centrally owned and managed. However, we see the future energy grid to be increasingly decentralized. Ongoing technology improvements and cost reduction erode market barriers to energy decentralization while promising significant benefit gains in energy efficiency, system reliability and resiliency, economic competitiveness and environmental sustainability. When LM resources are optimally deployed, they enhance grid operation. Examples of characteristics of ideal LM resources are:
  - Reduce distribution circuit peak load;
  - Mitigate steep over-supply and over-demand;
  - Mitigate the need for building additional capacity;
  - Replace traditional fossil fuel-based generation;
  - Reduce wear and tear on distribution equipment;
  - Aggregate to reach critical scale necessary to be considered as reliable resources in system planning and operation;
  - Reliable dispatchable;
  - Be centrally coordinated;
  - Provide required local capacity;
  - Others

Methodology

Key recommendations for future enhancement on ICA methodology:

- ***Include Resource Reliability/Uncertainty in ICA*** - In a simplistic explanation of the current ICA methodology, the integration capacity is determined by netting out DER impacts (i.e. positive or negative) on the integration capacity of a local distribution system. The current ICA methodology takes into consideration the uncertainties of DER impacts on the integration capacity by analyzing the fringe hours of highest and lowest loading conditions. The historical load patterns are analyzed and only on the highest loading conditions and lowest loading conditions are calculated. This current approach may be sufficient in a deterministic environment where the market penetration of DERs is still low, and most of the grid resources are centrally planned and managed.

  However, the future energy system will be composed of progressively more DERs that are owned and operated by numerous non-IOU market actors. This energy future requires more probabilistic modeling approaches to assess the impacts of DERs on integration capacity. This paper recommends the enhanced ICA methodology to include modeling parameters that account for the reliability/uncertainty of LM resources. The resource reliability/uncertainty variables need to be explicit parameters in the ICA equation to facilitate the modeling of what-if scenarios on the distribution system.

  One of the key purposes of probabilistic modeling is to reveal the values of aggregated DER. This new analytical approach should make use of the increasingly available “big data” and associated statistical analyses. For example, ICA modeling thus far has presumed that (a) DERs aren’t aggregated to provide services and goods, and (b) DERs cannot be relied upon to avoid degradation of the distribution system. Statistics can be used to understand and plan for DERs that enhance both reliability and resiliency without compromising affordability or sustainability.

  Additionally, it would be worthwhile to discuss whether a refined ICA methodology based on hourly profiles could be more effective in optimizing the integration capacity of a local distribution system that might be hosting the expanding DERs deployments with increasingly volatile load profiles.

- ***Model Resource Impacts on Key Indicators of ICA*** – The determination of integration capacity involves assessments of local grid equipment related to thermal levels, steady state voltage, voltage fluctuation, operational flexibility, protection limits plus other key indicators. Each Load modifying resource, DER, could impact one, several or all the key indicators, which will impact the local system’s integration capacity. Again, we envision that measured reliability and quantitative parameters for each LM resources would be embedded in the numerical modeling of each key indicator for integration capacity to support the modeling of contingency scenarios for the local distribution systems.

- **Assess Potential Impacts of Existing and New LM Resources on Integration Capacity** – The future ICA methodology should assess the potential impacts of both existing and new LM resources on integration capacity based on how the existing LM Resources have been able to affect the historical load profiles on the local distribution grid. For example, if a circuit has an EV charging that can be controlled in response to local grid conditions, the future ICA methodology should evaluate how this EV charging profile could be changed to adapt to a new DER added to the local grid. The objective of changing the existing EV charging profile is to minimize negative impacts to local integration capacity. Growth Scenarios must be incorporated into the ICA methodology for actionable planning purposes.

- And lastly, but more importantly is that future ICA methodology must provide integrated grid engineering as well as non-grid engineering analysis (e.g. econometric, environmental impacts, etc.) in order to present a completed and cohesive scenario outcomes for effective and meaningful evaluation by the stakeholders.

3.2.f: Development of ICA validation plans, describing how ICA results can be independently verified

Andrew Mills and Liang Min (LLBL/LLNL)

Context:

Many of the concerns with the initial ICA methods have been addressed by moving to more of the iterative methods (i.e., direct simulation of the distribution grid using the commercial models), applying the analysis to all feeders, etc. Some questions still remain, as outlined below.

Objectives of Validation:

- Believability – Will parties that cannot replicate the ICA analysis be able to trust the outcome?
- Repeatability – Would different independent experts come to the same ICA value given the same circuit?
- Broadly applicable (within reason – don't need one tool for all situations) – Do modifications need to be made to the models/methods across different feeders or load areas?
- Platform for improvements – How can third-parties develop and demonstrate improvements to the ICA methods?
- Comfort – Can the validation of the ICA methods help utilities gain comfort with the results, resulting in easier interconnection where the ICA shows available capacity?

Proposed Scope Questions:

Which components of the ICA need to be verified?

- Three primary steps in the ICA: (1) input data, (2) ICA methodology, (3) tools

What steps should the IOUs take to verify their input data?

- How well are capabilities/impacts of existing DERs in providing ancillary services captured in the hourly profiles?
- Are any of these steps within the scope of the ICA (or are they bigger issues, best dealt with elsewhere?)

What issues need to be addressed to verify the ICA methodology?

- How appropriate are the various sub-criteria within each criteria?
    - Are there additional **criteria** that might be applied by some experts but not by others?
- How appropriate are the **thresholds** used for each criteria?
    - Is there broad agreement on the thresholds?
- Are the methods/ assumptions transparent?
- Is additional work needed to verify some of the streamlined methods where the iterative method is not available (e.g., voltage flicker)?
    - Can the streamlined methods be verified with more detailed analysis, either through comparisons to other detailed simulations (e.g. detailed time-series analysis) or to field tests?
- How do results compare across ICA methods (EPRI, Sandia, NREL) when tools and data are kept the same?
    - ICA methods (particularly on criteria and thresholds) are still an active area of research.

What issues need to be addressed to verify the tools?

- Do parameters or underlying code work without modification on alternate data sets?
- How do results compare across tools (CYME, Synergi, OpenDSS, GridLab-D) when the data and ICA methods are kept the same?

How much uncertainty exists in the ICA results, given uncertainty in the underlying data? How much uncertainty exists, given differences in the choice of thresholds across experts?

- Is that uncertainty acceptable in terms of repeatability, believability objectives?
- Where is there the greatest potential to reduce uncertainty in the ICA results?

What are the appropriate datasets to serve as a reference point for validation and third-party improvements to the method?

- IEEE 123
- IEEE 8500
- PG&E 12 representative feeders
- Others? How many are needed?
- How much time is needed for third-parties to do additional analysis?

ICA elements to support streamlined interconnection

Brandon Smithwood (SEIA) and Jim Baak (Vote Solar)

Context:

As part of the completion of Demonstration A in the Distributed Energy Resources Proceeding, Southern California Edison, Pacific Gas & Electric, and San Diego Gas & Electric ("the utilities") have developed a visual representation of the hosting capacity on a particular line segment on an hour-by-hour basis (hereafter "hosting capacity line"). In order to analyze whether there is sufficient integration capacity for hosting a project, the utilities have proposed a technology agnostic generation or load profile as way for developers to specify the load/generation profile of a portfolio of DERs that may be deployed as part of a larger project at a node on the distribution system.

The Solar Energy Industries Association (SEIA) and Vote Solar raised a number of questions about the assumptions underlying both the hosting capacity line as well as issues to be explored in ensuring that the Integration Capacity Analysis supports a significantly improved interconnection process. In response to proposals by SEIA and Vote Solar, Community Environmental Counsel provided comments clarifying their "Click and Claim" interconnection proposal, proposed in this proceeding originally in 2015.

While data and assumptions underlying the ICA determine its accuracy, there are a range of questions to be explored related to refinements of the ICA that will determine its applicability to interconnection processes. In their July comments on the ICA demonstration projects[6], Community Environmental Council outlined a "click and claim" interconnection process, whereby a developer can use the ICA map to reserve interconnection capacity and be placed in the interconnection queue and interconnected via an automated process. SEIA and Vote Solar do not necessarily endorse this specific proposal, but believe it is a vision to help guide refinements of the ICA to ensure that the Analysis is a sufficient tool to underpin a significantly improved fast-track interconnection process. The proposed areas of refinement to explore in preparation of the final report could also facilitate interconnection of projects that ultimately do not qualify for fast-track interconnection.

Key Scoping Questions Related to Integration Capacity Analysis Clarification

1) **What assumptions about load and load shape inform the hosting capacity line? Are these assumptions appropriate?**
   Based on SEIA and Vote Solar's review of the Interim Reports filed on September 30th it is not clear what contingencies underpin the hosting capacity line: are they 1 in 2, 1 in 10, or 1 in 30 year recurrence? Are 24 hour "days" represented in the hosting capacity line based on a sampled day, maintaining inter-hour autocorrelation or assembled statistically from sampled hours to create a "worst case" synthetic day?

   In working group meetings, on several occasions, participants noted that the performance and availability of flexible load and PV generation is covariant with underlying drivers of distribution system loading such as weather conditions, weekday / weekend, and pricing structures. SEIA

[6] Comments of Community Environmental Council on Demo Projects A and B and Proposing Demonstration Projects, July 22, 2016, filed with the California Public Utilities in R.14-08-013 and related matters (A.15-07-002, A.15-07-003, A.15-07-006)

and Vote Solar believe it is important to understand how assumptions about these contextual data drive assumptions about loads and load shapes, and subsequently, hosting capacity analysis. SEIA and Vote Solar note that for the first two points, this data is readily available commercially if the date, time, and geolocation data associated with each hosting capacity line data point is provided.

2) **What assumptions about utility and DER equipment technical functions are incorporated into the calculation of the hosting capacity line? Are these assumptions appropriate?**
   What assumptions are made in the calculation of the hosting capacity line related to the abilities of distribution system equipment to manage episodic, short duration violations of thermal, voltage, protection and/or reliability/safety limits? What assumptions are made about DER equipment management of episodic, short duration violations of limits? For example, the required autonomous functions in the state's smart inverter standards manage some voltage deviations.
3) **What is the relationship between the ICA and Locational Net Benefit Analysis?**
   A number of parties have expressed an interest in better understanding the relationship between the ICA and the Locational Net Benefit Analysis.

<u>**Key Scoping Questions Related to Creating an ICA with Capabilities to Support Dramatically Streamlined Interconnection**</u>

1) **How can the utilities' proposed technology-agnostic load/generation profile be refined to accommodate portfolios of DER combinations that are both load and generation? Can a technology agnostic profile be accomplished by using a net-generation/load curve rather than a gross-generation/load curve? How would the ICA accommodate project designs for self (i.e., non-export)- or "smart"- supply?**
   While the ICA method currently under development as part of Demonstration A allows for an "agnostic" load or generation profile, it is a gross generation- or load- profile of the DER or portfolio of DERs. This requirement for gross generation/load profiles is problematic from SEIA and Vote Solar's vantage point since developers are likely to marry loads and load controls with generation, meaning that load or generation behind the meter will be "invisible" or "masked" in front of the meter. SEIA and Vote Solar argue that one area where evaluating gross generation/load versus a net generation/load is particularly important is the treatment of non-exporting systems.
2) **How can the Integration Capacity Analysis data be formatted to allow for ease of analysis by customers, third-parties, and other stakeholders?**
   Can and should data be provided programmatically in machine readable formats (e.g., through public RESTful APIs)?
3) **What is the appropriate frequency at which the ICA is updated?**
   SEIA and Vote Solar argued that near-real-time updates are needed to support an enhanced interconnection process. Community Environmental Council made a similar suggestion in its July 2016 comments on Demonstration A and Demonstration B in R.14-08-013. Real-time or near-real-time updates will be necessary for any interconnection process automation.
4) **What other data should be included in the ICA maps to help facilitate interconnection?**
   SEIA and Vote Solar suggested that distribution system upgrade costs (should the project exceed hosting capacity) be included as well as the queue of projects and the capacity remaining assuming projects are completed.

Integration of Growth Scenarios for Decision-Making Purposes

Sky Stanfield (Interstate Renewable Energy Council)

The May 2, 2016 Assigned Commissioner's Ruling (ACR) Refining the Integration Capacity Analysis (ICA) methodology and authorizing the Demonstration A project requires the projects to be conducted using two types of scenarios: a 2-year growth scenario and Growth Scenarios I and III as were originally proposed in the DRP Applications.

The working group has not yet had in-depth discussion about growth scenario methodologies, how these growth scenarios will be integrated with the ICA, or how the corresponding results can be used for planning and decision-making purposes.

In addition to being used for near-term decision-making regarding interconnection (which the Working Group has discussed to some extent), one of the other important functions of the ICA is to be able to assist with planning decisions for future operations and needs of the distribution system. One of the central concepts of "Integrated Distribution Planning"[7] is that the ICA, when combined with accurate and detailed forecasts of DER growth, can be used to help utilities identify circuits that need upgrading in order to accommodate forecasted DER *prior* to reaching the "tipping point" through an individual interconnection application. Using this set of tools, the utility should be able to take proactive steps to make those upgrades OR to proactively seek out DER-based solutions.

There are important policy issues that need to be addressed to make this happen, including determining where it makes economic sense to make proactive upgrades to accommodate growing DERs, as well as the appropriate mechanism for funding those upgrades. These questions are likely outside of the scope of the ICA working group, but there are important questions about the accuracy of the ICA + Growth Scenario results that are appropriate for discussion by this working group.

Specifically, we propose the following topics for discussion:

- An evaluation of the results of the ICA analysis with the growth scenarios:
  - How realistic are the outcomes on a circuit-by-circuit basis?
  - Are there modifications to the methodology that would make the results more accurate and useful for planning purposes?
  - How should the scenarios be integrated with the ICA for planning purposes? What are the methodological considerations at play?
  - Are particular criteria violations (i.e. voltage, thermal, etc.) more or less difficult to accurately predict using the growth scenarios in the ICA?
- Are the results actionable?
  - Are they sufficiently accurate and granular to help determine, when used together with the ICA, where upgrades will be needed to accommodate growing DERs?
  - How long of a timeframe out can the results be used for decision-making? How frequently would scenario forecasts need to be made to ensure they remain useful?
- Do the results inform the type of action that can be taken, i.e. whether a wires upgrade or DER solution is possible? Should they?

[7] http://www.irecusa.org/publications/integrated-distribution-planning-concept-paper/

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ICA that allows DERs to serve peak load conditions, while maintaining grid stability during low-load conditions

Mark Handschy and Asaf Nagler (SolarRetina LLC)

The proposed "agnostic" ICA methodology provides an important new way to think about how hosting capacity can vary with time of day and month of the year. Given California's goal of obtaining 50% of its electricity from renewable resources by 2030, could this concept be extended in ways that would help DERs play a larger role helping California achieve this goal?

Consider, for example, the circuit net-load profile shown by PG&E in their interim report.[8] The bottom blue lines of these profiles provide opportunity for

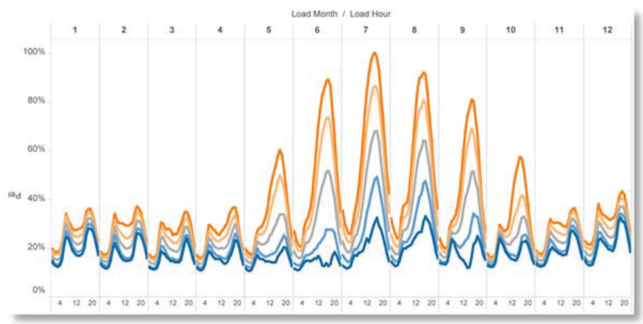

Figure 7: Statistical Load Shapes built from Historical Data (288*X Hours)

[8] "Pacific Gas and Electric Integration Capacity Analysis for Distribution Resource Planning. Demonstration A – Enhanced Integration Capacity Analysis. Report: PG&E Methodology Details and Technical Assumptions," filed September 30, 2016.

additional distributed generation beyond a less flexible “heuristic” limit like the minimum daytime load. However, if the blue lines are used throughout each month to regulate the maximum export of DERs connected to feeder, they then prevent DERs from addressing the very high loads represented by the orange lines. This needlessly presents a “barrier to the deployment of DERs.” We propose a long-term refinement topic that addresses the ability for DERs to satisfy peak load conditions while also maintaining grid stability during low-load conditions

The higher net loads in the Figure arise from simple, knowable variables that even not-so-smart inverters could adaptively respond to. Load typically varies according to ambient outdoor temperature and building occupancy. In practice, this means that loads are higher during weekdays than on weekends, and higher when it is hot outside than when it is cold outside. The presently proposed ICA profiles don’t provide this information, preventing implementation of simple DER control schemes that could allow more generation when it is a hot weekday and self-limit on cold weekends. For example, PVs with inverters programmed to limit their own outputs on weekends could contribute substantially to reduction of weekday peak feeder loads. Similarly, since higher net loads occur on warm days, inverters programmed to limit their outputs according broadcast weather forecasts could also serve a substantially greater fraction of hot-day feeder load. The ICA, as currently proposed, does not provide sufficient information to allow one to design even a rudimentary DER solution that addresses peak load conditions while also ensuring grid stability during low-load conditions.

Therefore, we ask that additional ICA profiles for occupancy and temperature-driven load patterns be developed as part of the long-term refinement. In practice, this could mean that ICA would provide four minimum-ICA profiles as listed in the table below (where “Cold” could mean any day with a forecast high temperature below some agreed-upon monthly threshold; “Hot” otherwise):

	“Hot” Day	“Cold” Day
Weekday		
Weekend		

With such information, DERs could safely begin to serve the higher loads shown by the orange line and then self-restrict generation during times of low net-load.

849492.1

DRP Long-term Refinements: Leveraging National Lab Capabilities

Goncalo Cardoso, Sila Kiliccote and Andrew Mills

Scope: Under the DOE Grid Modernization Initiative, a multi-lab team is working on a regional demonstration project “DER Siting and Optimization Tool for California”. The objective of this demo project is to deliver a software platform to promote high penetration levels of DER in California by coupling optimal behind-the-meter investment and operation decision models with Transmission & Distribution co-simulation capabilities, and map sites with high economic potential for microgrid and DER deployment, identify DER adoption patterns taking into account resource coordination (e.g., PV and storage, and combined heat and power solutions), and evaluate impacts of DER penetration on the bulk electric grid. The project team wants to share the project idea and interim results with the DRP working group and discuss how this software platform could be used to inform different stakeholders on the locational benefits of DER as well as provide additional insights to hosting capacity analysis. We envision this platform supporting the long term planning efforts by exploring different scenarios of adoption and pointing out challenges and potential solutions as the systems evolve.

Technologies Developed by the GMLC Team: The primary technology development of the GMLC project is creating a linkage between three types of models: a customer-focused DER adoption model, a distribution system powerflow model and a transmission system powerflow model. The Distributed Energy Resource Customer Adoption Model (DER-CAM) uses customer specific characteristics, including electric, heating, and cooling loads, to identify the optimal combination of DERs and grid-supplied power to meet their loads. DERs can include technologies like PV, wind, CHP, electric storage, EVs, or hydrogen storage. The transmission and distribution powerflow models are solved simultaneously in a co-simulation environment called GridDyn, which can be solved in reasonable times by leveraging high-performance computing.

For a given feeder, the project will identify the optimal customer DER adoption at each node, then use that decision to create a modified net load curve for the distribution model (based-on GridLab-D). The distribution model will then be solved simultaneously with the transmission system. The main challenges addressed in the project are related to connecting these different tools then using automation to scale up the size of the number of customers. The project will illustrate the proof-of-concept, but with the right data could be used to investigate cases specific to California.

Discussion questions:

- What is a viable pathway for this new type of technology to benefit the DRP?
- What insight from this project can inform the long-term refinement of the DRP?
  - Interconnection use case:
    - Reflecting potential interactions between the transmission system and distribution system in ICA analysis.
    - ICA dispatch strategies to maximize use of DER without exceeding ICA limits.
    - Combinations of DER to minimize ICA needs.
  - ICA planning use case:
    - Use DER-CAM to identify which customers are likely to adopt DER
    - Develop dispatch profiles and quantity of DER based on customers accessing other value like ancillary services
- What data is needed by the GMLC team to produce CA-specific results?
  - Actual feeder data, time-series of loads at the customer level

- What stage of development should the technology be at to be integrated into the utility processes? Does it need to be a stand-alone, user-friendly software package?

APPENDIX B: Meeting Summaries

In its facilitator role, More than Smart publicly documented all meetings online at http://drpwg.org/sample-page/drp/ with requests for WG input.

Meeting summaries, participation lists, submitted stakeholder comments, and audio or webinar information when available, can be found at:

http://www.drpwg.org

Meeting Date	Topic(s)
May 12 – 1:00pm-3:00pm Webinar	Presentation: http://drpwg.org/wp-content/uploads/2016/05/R1408013-Joint-WGs-kick-off-deck-presentation-0512162.pptx Recording: click here =
May 18 – 10:30am-12:00pm Webinar	Seeking input regarding 1) use of power flow analysis and 2) level of granularity Presentation: http://drpwg.org/wp-content/uploads/2016/05/ICA-Response-Presentation-to-Energy-Division-Final.pptx
June 1- 9:00am-3:00pm In person	First discussion of demonstration implementation plan before June 16th submission Presentation: http://drpwg.org/wp-content/uploads/2016/05/6.1.16-ICA-WG-meeting-.pptx Final consensus recommendation: http://drpwg.org/wp-content/uploads/2016/05/ICA-WG-Final-edits-at-6.1.16-meeting.pdf
June 9 – 9:00am-3:30pm In person	Second discussion of demonstration implementation plan before June 16th submission Presentation: http://drpwg.org/wp-content/uploads/2016/06/6.9.16-ICA-meeting-draft-final_clean.pptx Meeting notes: http://drpwg.org/wp-content/uploads/2016/06/ICA-WG-High-Level-Summary-06092016.docx Participant list: http://drpwg.org/wp-content/uploads/2016/06/ICA-and-LBNA-Working-Group-Participation-List-060916.pdf Recording: click here
July 5 – 2:00pm-4:00pm Conference call	Call to discuss submission of demonstration implementation plan

	Presentation: http://drpwg.org/wp-content/uploads/2016/06/work-plan-matrices.xlsx
July 25 – 9:00am-3:30 pm In person	Discussion of submitted stakeholder comments on demonstration implementation plans Use cases 3.1.c/3.2.c – data and maps 3.1.b – portfolio analysis Presentation: http://drpwg.org/wp-content/uploads/2016/07/ICA-Working-Group-072516_final-1.pptx Meeting notes: http://drpwg.org/wp-content/uploads/2016/07/July-high-level-notes-ICA-LNBA.docx Demo A data table: http://drpwg.org/wp-content/uploads/2016/07/DRP-Demo-A-Map-Data-Tables-Sample.xlsx Demo A mapping proposal: http://drpwg.org/wp-content/uploads/2016/07/Demo-A-Mapping-Proposal.docx Participant list: http://drpwg.org/wp-content/uploads/2016/07/July-ICA-Working-Group-Participation-List.pdf
August 31 – 9:00am – 4:15pm In person	Use cases 3.1.b – smart inverters 3.1.f – smart meter/customer load data Data access Presentation: http://drpwg.org/wp-content/uploads/2016/07/ICAandLNBA_August31_V2-1.pdf Meeting notes: http://drpwg.org/wp-content/uploads/2016/07/August-high-level-notes_v2.docx Participant list: http://drpwg.org/wp-content/uploads/2016/07/August-ICA-WG-Meeting-Participant-List-.pdf Recording: click here
September 30 – 9:00am-4:00pm In person	3.1.e – comparative analysis 3.1.b.i – portfolio analysis 3.1.d – computational efficiency Data access Presentation: http://drpwg.org/wp-content/uploads/2016/07/ICAandLNBA_September30tb.pptx Meeting notes: http://drpwg.org/wp-content/uploads/2016/07/September-ICA-LNBA-meeting-

	summary_draft.docx Participant list: http://drpwg.org/wp-content/uploads/2016/07/September-ICA-LNBA-Working-Group-meeting-participant-list-1.pdf Recording: click here
October 17 – 9:00 am-4:00pm In person	Demo A update 3.1.d – computational efficiency 3.1.f – smart inverters 3.1.e – comparative analysis 3.1.b.i – DER portfolios 3.2.a-g – long-term scoping discussion Presentation: http://drpwg.org/wp-content/uploads/2016/07/ICA-WG-2016-17-Oct-final.pptx Meeting notes: http://drpwg.org/wp-content/uploads/2016/07/October-ICA-meeting-summary_draft.docx Participant list: http://drpwg.org/wp-content/uploads/2016/07/October-ICA-participant-list.pdf Recording: part 1, part 2, part 3, part 4
November 18 – 9:00am-4:00pm In person	Review of Working Group short term final report outline Long-term scoping discussion of 3.2.a-g plus other topics Data Presentation: http://drpwg.org/wp-content/uploads/2016/07/ICA-WG-Nov-18_v2.pdf Report outline: http://drpwg.org/wp-content/uploads/2016/07/LNBA-super-outline-draft_v2.docx Meeting notes: http://drpwg.org/wp-Scontent/uploads/2016/07/November-ICA-Meeting-Notes.docx Participant list: http://drpwg.org/wp-content/uploads/2016/07/November-18-ICA-participant-list.docx Recording: click here
December 13 – webinar	Review of Working Group interim long-term report topics Presentation: http://drpwg.org/wp-content/uploads/2016/07/ICA-WG-Dec-13-slide-deck.pptx Participant list: http://drpwg.org/wp-content/uploads/2016/07/December-ICA-Participant-List.docx