
LNBA Subgroup on Avoided Transmission Value

October 16, 2017

In-person meeting

drpwg.org

Agenda

Time	Topic
9:30 – 9:45	A. Intros, overview, level setting
9:45 – 10:45	B. Avoided cost incremental to the DER forecast (deferral use case) CAISO TPP analysis on mitigation alternatives and process gap (CAISO) How is the avoided cost value incorporated into the LNBA tool? (PG&E)
10:45– 11:15	C. Using and incorporating a no-DER forecast: implementation considerations and challenges of the planning analysis
11:15 – 11:30	D. Break
11:30 – 12:15	E. Consideration of unplanned investment within the cost-effectiveness use case
12:15 – 12:30	Wrap up and next steps

Overview and Level Setting

- ACR: Directs Working Group to form technical subgroup in LT refinements to develop methodologies for non-zero location-specific transmission costs
- To date, we have hosted 6 calls and 3 additional discussions
- Additional direction provided the Sept 26 Final Decision:
 - Affirming the two use cases for deferral opportunities and for information/heat map purpose
 - Affirming the third use case, for use in cost-effectiveness evaluations
- Question for the Subgroup: What is a realistic and achievable outcome for the subgroup by the Jan 8 report deadline?
 - Initial development of methodology or multiple methodology options, and identified pros/cons with approach(es)
 - Detailed considerations on next steps with regards to process alignment and additional information needed
- Written content needed for the final WG report (due Jan 8)

Avoided cost incremental to the DER forecast (deferral use case)

CAISO TPP process: clarification on how mitigation alternative proposals are assessed to meet the defined need
identified process gap between recommended non-wires alternative, approval of TPP, and process at CPUC

How is the avoided cost value included in the LNBA tool?

How are partial project deferrals/reduction of project size considered, given different value components?

Implementing No-DER Forecast within the Cost-Effectiveness Use Case

[D. 17-09-026](#) states that “... DPA-level avoided T&D values developed for input into DERAC should not reflect the forecast of autonomous DER growth anticipated to occur because of existing tariffs and programs.”

How can the CAISO incorporate this planning analysis?

Quantifying unplanned transmission investment in cost-effectiveness use case

[D. 17-09-026](#) asks us to consider probability of unanticipated transmission spending avoidable by DERs to a window consistent w/ maximum useful life of certain DERs (30 years). This probability could reflect sensitivities for high-trajectory load and DER growth forecasts.

- How can we establish a historical trend of actual transmission investment? How do those compare with forecasts?
- What percent of future transmission investment is influenced by DERs? How does this vary with changes in forecast assumptions?
- How is unplanned transmission investment valued both within the planning horizon (10 years) and outside of the planning horizon?
- How are locational differences valued?

Quantifying unplanned transmission investment in cost-effectiveness use case

- One initial starting point: Within the planning horizon, projects identified in earlier years (e.g, years 1-5) are more certain in size, type and location. In later years (e.g., years 5-10), we may be fairly certain about needs but less certain about project types or location. The farther out you go w/r/t number of years, the value may more closely resemble marginal transmission cost. After 10 years/outside of the planning horizon, there are no longer identified deferrable projects, so value more closely resembles MTCC, escalated X%/year.
- Clarifying questions: do these further years accurately capture the entire quantity of needs? How well are both projects and locations defined? Are the values further out in the time horizon peanut buttered? What relevant data is needed?

Locational Net Benefit Analysis Working Group

October 16, 2017

In-person meeting

drpwg.org

Agenda

Time	Topic
1:30 – 1:45	A. Intros review schedule and deadlines
1:45 – 2:15	B. Unplanned grid needs, including: (1) Methods of evaluating location-specific benefits over a long-term horizon that matches with the offer duration of the DER project; (2) develop a methodology to quantify the likelihood of a deferrable project emerging in a given location; (3) value locational value beyond 10 years
2:15 – 3:15	C. Asset life extension/reduction SEIA/Tesla Joint IOUs
3:15 – 4:00	D. Benefits of increased reliability (non-capacity related) provided by DERs SEIA/Tesla Joint IOUS
4:00 – 4:30	E. Other: additional Group III speculative topics (per June 7 ACR) and stakeholder priority items Benefits of DERs reducing frequency/scope of maintenance projects Benefits of DERs allowing for downsized replacement equipment Uncertainty metric for planned projects

ICA and LNBA Working Group Background: June 7 ACR

Interim status reports are due as follows:

- **Group I: August 31, 2017**
- **Group II, III, IV: October 31, 2017**

The groupings, scoping documents, and interim status reports help form a tentative schedule for the Working Group going forward.

The ACR indicates that the Working Group is meant to pursue and develop the scoped topics to the fullest extent possible, including methodological development and/or modeling demonstrations where feasible, but also recognize that certain items may prove unworkable at this stage of ICA and LNBA development. In such cases, the Working Group is directed, in the status reports and Final Long-Term Refinement report, to document the extent of discussions, reason(s) for rescinding or tabling the topic, and relevant considerations and/or implementation plans (if any) for further discussions and methodological development beyond the Working Group process set forth herein.

Remaining Schedule and Deadlines

Objectives:

Ensure all stakeholders have opportunity (and sufficient time) to develop and contribute proposals and recommendations.

Ensure all stakeholders have opportunity to *respond* to proposals and recommendations.

Ensure all content development is complete *before* MTS begins the process of compiling and summarizing information for the Final Report.

Avoid late substantive additions that create contention and controversy during the drafting and editing of the Final Report.

Project plan: Key points

Main idea: All substantive proposals, recommendations, arguments, alternative recommendations, counter-arguments, analyses, and discussion ideas are submitted *in writing* prior to beginning the Final Report drafting process in early December.

The Final Report will consist solely of content drawn from previous written submittals.

The Review/Edit process will primarily be an opportunity for stakeholders to suggest *clarifications*. Any request for content additions must reference a previous written document submitted to MTS.

Upcoming WG meetings: focus is on areas where additional consensus is likely to be achieved

Remaining Schedule and Deadlines

10/13: Written comments on Group II proposals due

10/16: LNBA Working Group meeting

10/17: ICA Working Group meeting

10/20: Group III/IV written proposals due

10/27: Written comments on Group III/IV proposals due

10/31: Group II-IV status reports due

11/3: Final deadline for original proposals (all proposals containing new ideas, recommendations, visions, etc. distinct from other written proposals or comments.)

11/10: Final deadline for response to original proposals

11/15 – 11/16: November WG meetings

12/5: Final comment on November meeting discussions

12/11: First draft circulated

12/15: First round of edits

12/18-12/19: December WG meetings

12/27: Second draft circulated

1/3: Final round of edits

1/8: Report due

Decision D.17-09-026 on Track 1 Demonstration Projects

<http://docs.cpuc.ca.gov/SearchRes.aspx?docformat=ALL&DocID=196747754>

Locational Net Benefits Analysis (LNBA) Working Group

IOU Slides

August 15, 2017



Items 8&9: Unplanned Grid Needs

- ACR Group III, Item 8:
 - “Develop a methodology to quantify the likelihood of an unplanned grid need (deferrable project) emerging in a given location
- ACR Group III, Item 9:
 - “Value locational value of DERs beyond 10 years ”
- For Both Items 8 & 9:
 - “[Should be considered the same] as valuing unplanned grid needs encompasses long-term (>10-year) grid needs. However, such values are speculative and likely difficult to quantify for practical use in the LNBA

Item 8: Unplanned Grid Needs within Horizon

- Capacity projects, the primary distribution service type subject to deferral by DERs, by their nature do not typically result from “unplanned needs” the IOU load addition process is set up to have visibility of capacity needs long before they arise due to typical load growth.
- The majority of unplanned needs that could arise in a short time periods are due to large spot load additions that either force the utility to construct voltage or capacity projects to accommodate new load in a short period of time i.e. new large water pumps, casino, high rise, manufacturing facility, etc.

Item 8: Unplanned Grid Needs within Horizon

- The IOUS as regulated utilities are obligated to provide capacity service for new interconnections within a “reasonable amount of time” SDG&E currently targets limiting time of interconnection of any load to be less than 2 years.
- The IOUs strongly believe in the societal economic benefits of getting a new load online as soon as possible and believe the interconnection process should not be slowed it down in anyway.
- Considering loads that drive unplanned grid needs are usually particularly large it would be difficult to stimulate DER market activity fast enough to meet such large needs in such a short timeframe.

Item 8: Unplanned Grid Needs within Horizon

- Many of the large spot load needs driving utility projects are also grid edge projects where the new load is in a location with absolutely no existing infrastructure. In these locations usually some type of utility project will be required regardless to establish grid connectivity.
- For grid connectivity projects the incremental cost of building extra capacity to accommodate future load growth is minimal so planners usually use these projects to optimize around potential future capacity needs.

Unplanned Grid Needs within Horizon

- The overwhelming barrier to entry from using DERs to address unplanned grid needs will most likely be timeframe.
- Given such a short time window to address a new need it seems impractical to rely on any type of passive incentive mechanisms to deploy DERs in a area to offset an unplanned project of any kind. It is likely some utility driven solicitation would be the only way to bring about a DER alternative to unplanned grid need.
- Demo C will shed light on the timeframe required to solicit for DERs as well as various DER type deployment timeframes

IOU Recommendation for Assessing DERs for Meeting Unplanned Grid Needs

1. The IOUs do not believe it is appropriate to assess DERs at any one location for deferring unplanned grid investments as the risk of overpaying for DER services outweighs the small number of unplanned grid investments that will likely arise
2. The IOUs will attempt to limit the possibility of unplanned grid investments by continuing to refine the forecasting process and potentially shorten the presumed window of DER implementation through the Demo C process
3. The IOUs can track the number and \$ of unplanned capacity investments going forward to better understand the dollar value associated with unplanned grid investments.

Item 9: Grid Needs Beyond 10 Years

- The majority of system level benefits provided via DERs are already accounted for beyond 10 years and included in the LNBA tool. Any load reductions a DER may be provide is weighed against the forecasted price of system level values for Energy, emission, etc for the DERs assumed lifetime of the DER in the tool.
- The only benefit not included beyond 10 years are T&D values
- IOUs remain adamant that grid needs beyond 10 years are not reflected in the initial assessment of a DER on the grounds that forecasting grid needs beyond 10 years is a highly speculative.

Item 9: Grid Needs Beyond 10 Years

- The IOUs however acknowledge T&D value will absolutely still exist in years 10 + so long as a T&D project would still be needed without the DER providing capacity service at that time.
- It is for this reason the IOUs believe we should weigh or assess that value at the time of need rather than speculate on what the value could be thereby limiting the risk to ratepayers for valuing a service that may never be provided.
- This also protects ratepayers from entering contractual obligations that could result in them substantially overpaying for a service as result of reduced DER costs over time.
(similar to many PV contracts signed by thee IOUS in the beginning of the RPS mandates)

IOU Recommendation for Grid Needs Beyond 10 Years

1. Assess DERs for T&D value beyond then planning horizon at a later time such that they may be continually incentivized to remain online if value still exists in a later iteration of the planning forecast.

Distribution Asset Life Extension

LNBA Working Group
October 16, 2017



Background

- June 2017 ACR:
 - “Explore asset life extension/reduction value provided by DERs”
 - Priority: Group 3, “value proposition is speculative and potentially low; Working Group should only address these issues if time permits.”
- September 2017 Commission Decision
 - “We disagree [that DERs only provide locational value to ratepayers and the grid when they defer or avoid traditional capital investments] ... a number of value components ... in long-term refinement discussions, such as ... **asset life extensions**, can provide granular grid and ratepayers benefits independent of investment deferrals.”

Disambiguating Asset Life Extension and O&M

- **Asset Life Extension:** increasing the amount of time an asset remains in service (e.g. extending the mileage of your car)
- **Operations and Maintenance:** performing routine servicing and testing of assets (e.g. checking the oil, replacing the tires)

Disambiguating Asset Life Extension and O&M

- **Asset Life Extension:** increasing the amount of time an asset remains in service (analogous to extending the time or miles driven before you need a new car)
- **Operations and Maintenance:** performing routine servicing and testing of assets (e.g. checking the car's oil, replacing the tires)
 - From Demo B reports:
 - Functional test/exercise of switches, breakers, transformers, batteries, fire systems, voltage regulators; infrared inspections
 - Repair/replace broken reclosers, insulators, lightning arrestors, grounds, lids; reposition/replace poles, guys, anchors, crossarms; replace broken pads; adjust sagging conductors, remove equipment that's no longer used; replace missing signage, markings, etc.; trim overgrown equipment, clean out debris.

Why Distribution Assets are Removed from Service

1. Failure

- Manufacturing defects
- Environmental factors (e.g. corrosion)
- Specific incidents (getting hit by something, burned in a wildfire, etc.)
- Wear and tear (moving parts are only designed for so many operations)
 - DERs can impact this mode of failure
- Thermal Degradation (heat wave causes overloads and thermal break down)
 - DERs can impact this mode of failure

2. Obsolescence

- E.g. old design no longer considered safe or functional for current needs

3. Redeployment

- E.g. transformers not at end-of-life that are replaced as part of a forecasted need are usually kept in stock and redeployed.
 - Not a change in asset life, but an opportunity to defer a new asset which is already captured in LNBA under “distribution capacity”

Wear and Tear

- Lifespan of mechanical devices in the system – various types of switches primarily – is decreased as the number of operations they make increases.

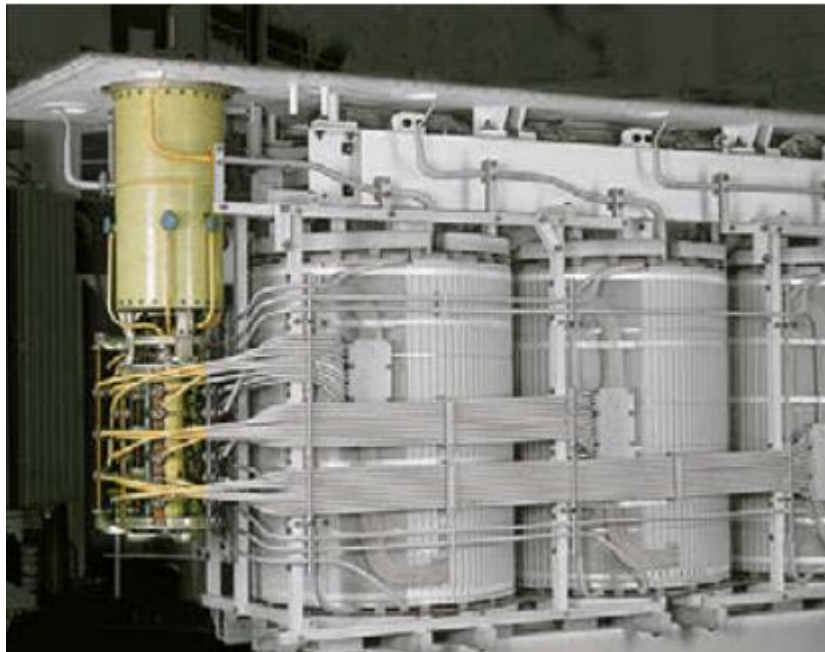


Table I: Characteristics of distribution feeders.

Circuit	A	B	C	D	E
Feeder length (km)	177.8	39.6	34.9	51.5	115.7
No. of Loads	1733	584	471	468	1178
Total peak load (MW)	11.1	8.3	4.8	3.7	5.9
No. of Capacitor banks	5	0	0	0	0
No. of Transformers & VRs	7	1	2	2	2
No. of PV systems (in 2012)	45	85	28	19	43
No. of PV systems (simulated)	432	340	364	104	387
Total rated PV capacity (MW _{AC} in 2012)	2.3	1.3	2.1	0.2	0.3
Large PV systems (#>0.5MW)	2	0	0	2	0
PV penetration in 2012 (%)	18%	15%	58%	4%	4%

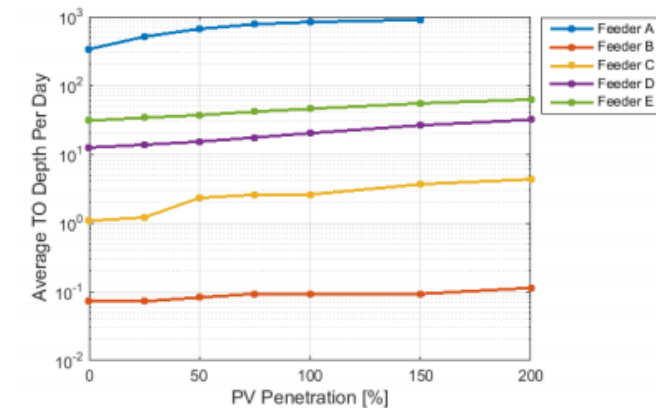


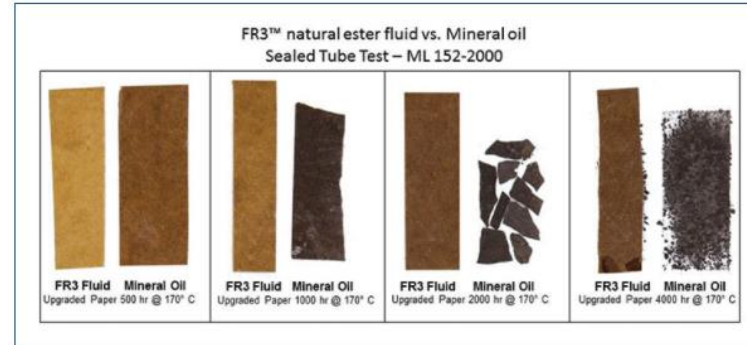
Fig. 1. Average of total TO depth per day during daytime. At 0% penetration feeders A, B, C, D, and E have 336, 0, 1, 12, 31 TO, respectively. The number of TO for feeders A, B, and C in the single and multiple scenarios are identical and independent of PV penetration level. An additional TO may occur at night, but these are not considered here.

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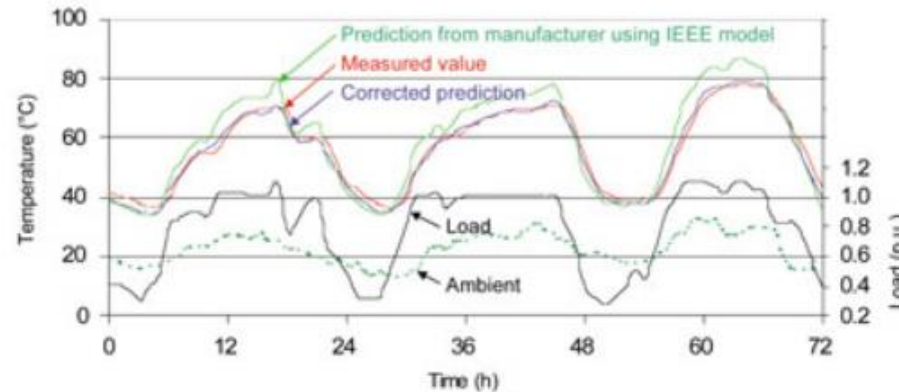
http://calsolarresearch.ca.gov/images/stories/documents/Sol3_funded_proj_docs/UCSD/CSIRDD-Sol3_UCSD_TapOpsReduction_20151120.pdf

Thermal Degradation of Transformers

- Prolonged exposure to high oil temperatures causes paper insulation in transformers to break apart, thus reducing transformer life (exacerbated by presence of water and oxygen).



- Transformer oil temperature is a function of absolute loading levels, durations and ambient weather conditions

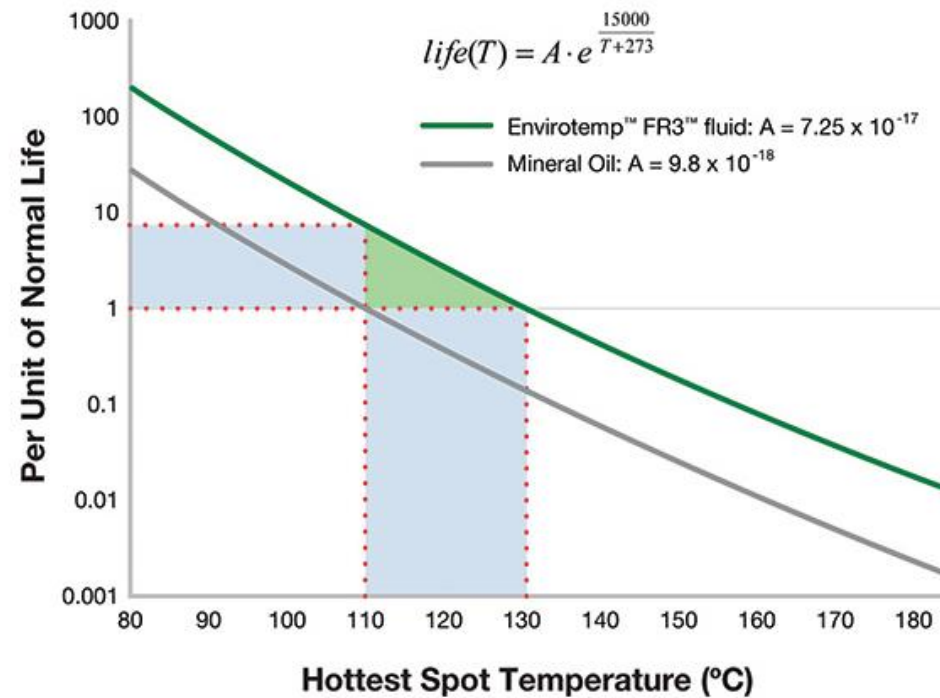


http://www.electricenergyonline.com/show_article.php?article=800

http://www.electricenergyonline.com/show_article.php?article=311

Thermal Degradation of Transformers

- Functional relationship between transformer life and temperature is typically modeled according to IEEE C57.154 Standard for the Design, Testing, and Application of the Liquid Immersed Distribution, Power, and Regulating Transformers Using High-Temperature Insulation Systems and Operating and Elevated Temperatures



Key Questions

- What assets fail due to thermal degradation or wear and tear – both type and quantity/percent?
 - In general, IOUs seek to avoid operating equipment at loading levels which might reduce expected life
- How do different DER profiles, combined with different underlying load profiles, effect transformer temperatures?
 - Any studies to show when DERs increase / decrease temperatures and how much? (e.g. 2016 HECO analysis finds backflow decreases transformer life under high penetration)
- How do different DER profiles, combined with different underlying load profiles, effect number of tap changer or switch operations?
 - Any studies to show when DERs increase / decrease number of operations and how much?
- How significant is the benefit / cost of an increase / decrease in distribution asset life?
 - Depends on
 - Quantity of assets that might be effected and ability to target those assets
 - Significance of life extension (e.g. adding/removing 5 years to a 40 year life?)
 - Value of life extension (e.g. NPV of adding/removing 5 years of life?)
- IOUs reached out to EPRI and are seeking available research, including ongoing studies at SCE.

Equipment Life Extension

LNBA Working Group

October 16, 2017

Equipment Life Extension

- Reduced loading can increase the life of distribution equipment
- Instances of high loading which can degrade equipment
 - Abnormal configurations
 - Periods of peak demand
 - Emergency operations
- Significant portions of a utilities distribution grid will routinely operate in overloaded conditions

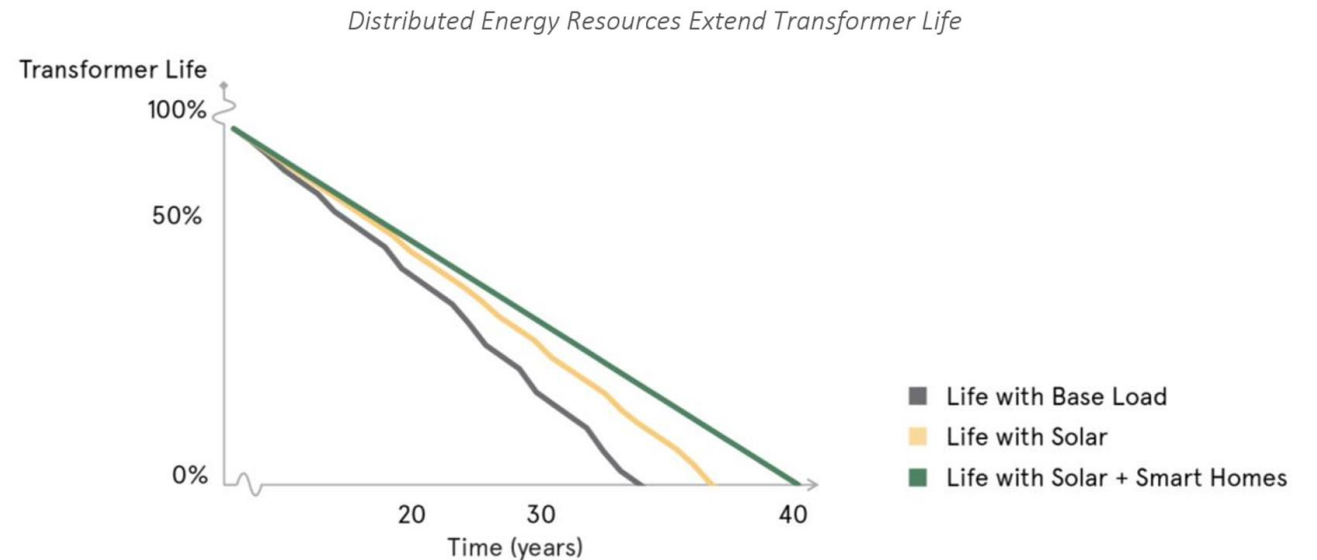


Figure from “Pathways to a Distributed Energy Future”
SolarCity (2016)

Methodology:

- Identified over 20 years ago: “The Value of Grid-Support Photovoltaics to Substation Transformers”, Hoff and Shugar, Pacific Energy Group and Pacific Gas & Electric (PG&E), 1993.
 - 0.5 MW PV facility had a value of \$398,000 in deferring the upgrade of a substation transformer that would have otherwise needed to be replaced.
- How to calculate:
 - reduced losses and resulting equipment degradation avoidance can be calculated using IEEE C57.12.00-2000 standard per unit life calculation methodology
 - Includes value of both deferral of assets (capacity) and energy efficiencies created by operating equipment more efficiently within ratings
- Ability of DERs to avoid these costs varies by how able they are to respond to conditions where overloading occurs (e.g., times of peak load)

Locational Net Benefits Analysis (LNBA) Working Group

IOU Slides

October 16, 2017



Item 14 – Non-Capacity Related Reliability

- ACR:
 - “Include benefits of increased reliability (non-capacity related) provided by DERs”
 - “Items 12, 14, 16, and 17: value proposition is speculative and potentially low”
- MTS Scoping Document:
 - “The WG needs to explore how to quantify this grid service beyond what is already included in the LNBA via back-tie capacity or microgrid services, what existing research may be leveraged, and how it may be included into the LNBA”

Item 14 – Non-Capacity Related Reliability

- What are the “Non-Capacity Related Reliability” services?
 - Detecting faults on the grid (e.g., circuit breakers, automatic reclosers)
 - Locating faults on the grid (e.g., sensing equipment)
 - Sectionalizing circuits to minimize the impacts of faults (e.g., switches)
 - Fixing standards violations (e.g. reconfigure underground structure or distribution pole)
- DERs cannot meet these services
 - DERs do not sense fault conditions and de-energize circuitry to maintain public safety
 - When connected to the distribution secondary system, DERs do not have the capability to inform fault direction or locate line sections on the distribution primary system when a fault occurs
 - DERs do not have the ability to transfer customers from a circuit experiencing an outage to a neighboring circuit
 - DERs cannot reconfigure physical equipment to address standards violations



Non-Capacity Reliability

LNBA Working Group
October 16, 2017

Reliability Back-Tie is Too Narrow a View of Reliability

- Competitive Solicitations Working Group defined one reliability service: “reliability-back tie”
- Reliability (Back-Tie): DERs can reduce load on a line section, allowing for load to be transferred from another line in an abnormal configuration
 - This is a very narrow view of reliability provided by DERs
- DERs already providing reliability service to customers
 - E.g.,
 - a data center which has secured it's own Uninterruptable Power Supply
 - A residential customer who has back up power

SEIA Proposal

- SEIA proposes including a value for reliability that captures the ability of DERs to reduce outages
- Options (LNBA WG/Commission can adopt one):
 - Method 1: reductions in cost of customer minutes of interruption (CMI)
 - Method 2: avoided cost of non-capacity reliability projects that would otherwise be used to improve reliability

How Utilities Value their Reliability Investments

- There are not defined *standards* for distribution reliability, though *measures* of reliability are used to evaluate a distribution utility's level of reliability (e.g., SAIDI, SAIFI, MAIFI)
 - No particular measure of SAIDI, SAIFI, etc. is “required” or deemed “reliable”. Reliability is a spectrum and what is sufficient reliability is subjective.
- What level of reliability is “reasonable and prudent?”
 - How much avoided costs from service interruption will be realized by utility investments to improve reliability.
 - Test of reasonableness = cost effectiveness: Cost of investments vs. avoided cost of customer interruptions used to determine cost effectiveness of investments
- Utilities have conducted customer studies to determine the value of avoiding electricity service interruptions
 - Nexant and Lawrence Berkeley National Laboratory has developed a national study for broader use
 - Individual utilities have conducted their own studies
 - These studies generate average values for avoided outages
 - Most value comes from a subset of commercial customers

Two methods for determining a reliability value for distributed energy resources

- Method 1: value of avoided customer minutes of interruption (\$CMI)
 - Use averaged values from customer interruption studies
- Method 2: value of avoided utility investments
 - What utility investments would otherwise be made to improve reliability?
 - Projects proposed in utility general rate cases to improve reliability
 - Category of investments termed “Non-capacity reliability projects”: This category of projects was required in the DRP May 2nd ACR on Track 1 (LNBA and ICA) pilots

Avoided utility investments

- Utility investments to improve reliability
 - Sectionalizing
 - Fault indication
 - Automation
- Projects that are due to degradation of a piece of equipment (rather than replacement for “obsolescence”) should be exempt

Table 2.1: Example Reliability Projects by PG&E

Project Category	Project Area	Description	Year
Distribution Reliability (not back tie capacity)	Chowchilla	Dairyland 1103, Improve reliability by isolating faults	2017
Distribution Reliability (not back tie capacity)	Chowchilla	El Nido 1102, Improve reliability by replacing deteriorated conductor	2017
Distribution Reliability (not back tie capacity)	Chowchilla	Chowchilla 1104, Improve reliability by replacing deteriorated conductor	2018
Distribution Reliability (not back tie capacity)	Chowchilla	Chowchilla 1104, Improve reliability by replacing deteriorated conductor	2018
Distribution Reliability (not back tie capacity)	Chico	Improve reliability by Replace Obsolete UG Switch	2017
Distribution Reliability (not back tie capacity)	Chico	Improve reliability by Replace Obsolete UG Switch	2017
Distribution Reliability (not back tie capacity)	Chico	Improve reliability by Replace Obsolete UG Switch	2017
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Distribution Reliability (not back tie capacity)	Chico	Improve reliability by Replace Obsolete UG Switch	2018
Distribution Reliability (not back tie capacity)	Chico	Improve reliability by Replace Obsolete UG Switch	2018
Distribution Reliability	Chico	Improve reliability by Replace Obsolete UG Switch	2018

Table of example non-capacity reliability projects c/o PG&E
December 2016 DRP Track 1 Pilot report

Should DER reliability be a benefit to all ratepayers?

- Averaged avoided customer outage costs are used to justify investments that are socialized
 - Most of the cost of interruptions are born by a small number of large commercial customers, small residential customers have low values for customer interruptions
- Many of these large customers may already be investing in distributed energy resources to avoid interruptions
 - As more customers adopt distributed energy resources there is a decreased need for investments to achieve these reliability benefits

Item 16 – Reduction of Maintenance Projects

- ACR:
 - “LNBA should value benefits of DERs reducing the frequency/scope of maintenance projects”
 - “Items 12, 14, 16, and 17: value proposition is speculative and potentially low”
- MTS Scoping Document:
 - “The WG needs to explore whether this potential exists, how to quantify this grid service, what existing research may be leveraged, and how it may be included into the LNBA.”

Item 16 – Reduction of Maintenance Projects

- Operations and Maintenance includes:
 - Equipment testing to ensure proper functionality
 - Examples: Fire systems, testing operations of switches and breakers
 - Scheduled equipment and structure inspections
 - Distribution equipment has specific scheduled inspection timeframes included in standards (Transformers, Switches, Circuit Breakers, etc)
 - Examples: Substation transformer dissolved gas analysis, distribution switch oil/gas levels, fix signage/markings
 - Vegetation management
- There is currently no reliable evidence that DERs can defer the operations and maintenance work listed above

Item 17 – Downsizing Equipment

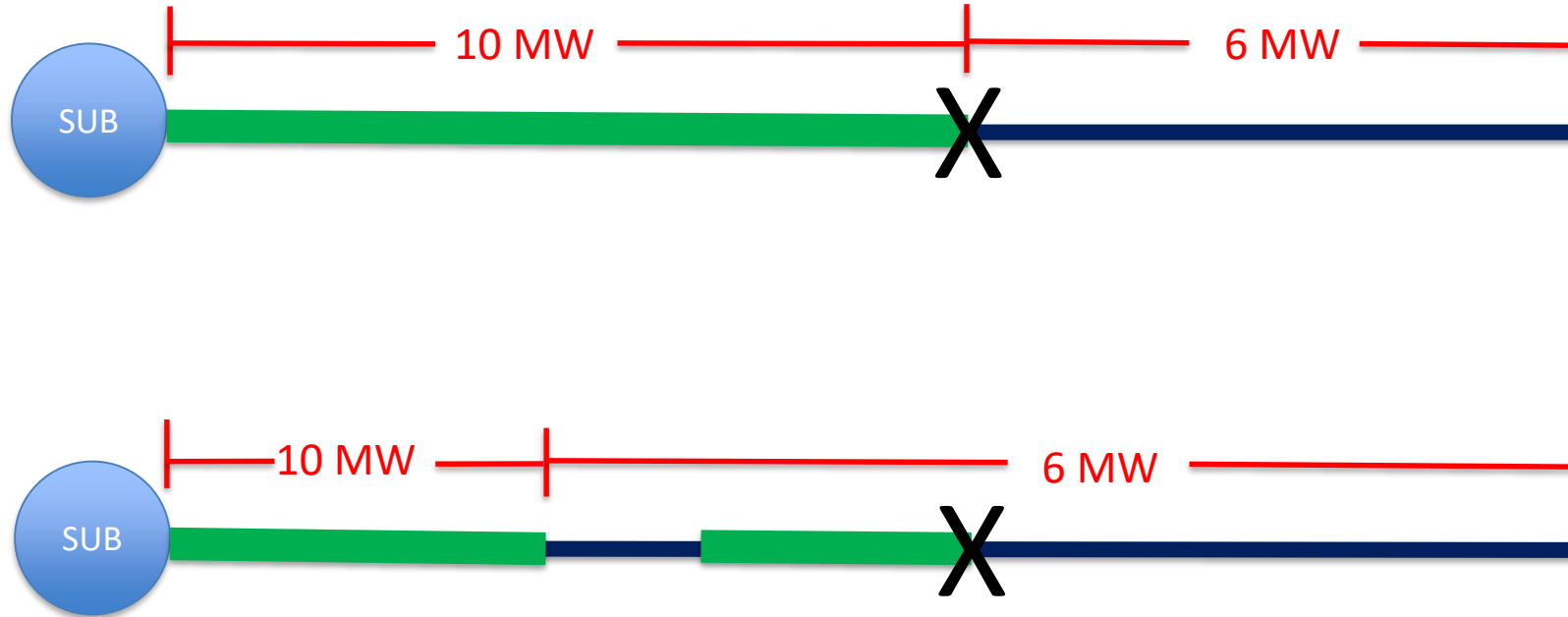
- ACR:
 - “LNBA should include benefits of DER penetration allowing for downsized replacement equipment due to be installed in the case of equipment failure or routine replacement of aging assets”
 - “Items 12, 14, 16, and 17: value proposition is speculative and potentially low”
- MTS Scoping Document:
 - “The WG needs to explore whether this potential exists, how to quantify this grid service, what existing research may be leveraged, and how it may be included into the LNBA.”

Item 17 – Downsizing Equipment

- Decreases resiliency of the grid, contrary to the future plug and play electric grid vision
 - Reduces capacity to serve future load and generation growth
 - Potentially results in installation of larger equipment at a later date, resulting in higher costs to customers (installing equipment twice)
 - Reduces ability to transfer load and/or generation between circuits due to limited capacity from downsized equipment (loss of grid flexibility)

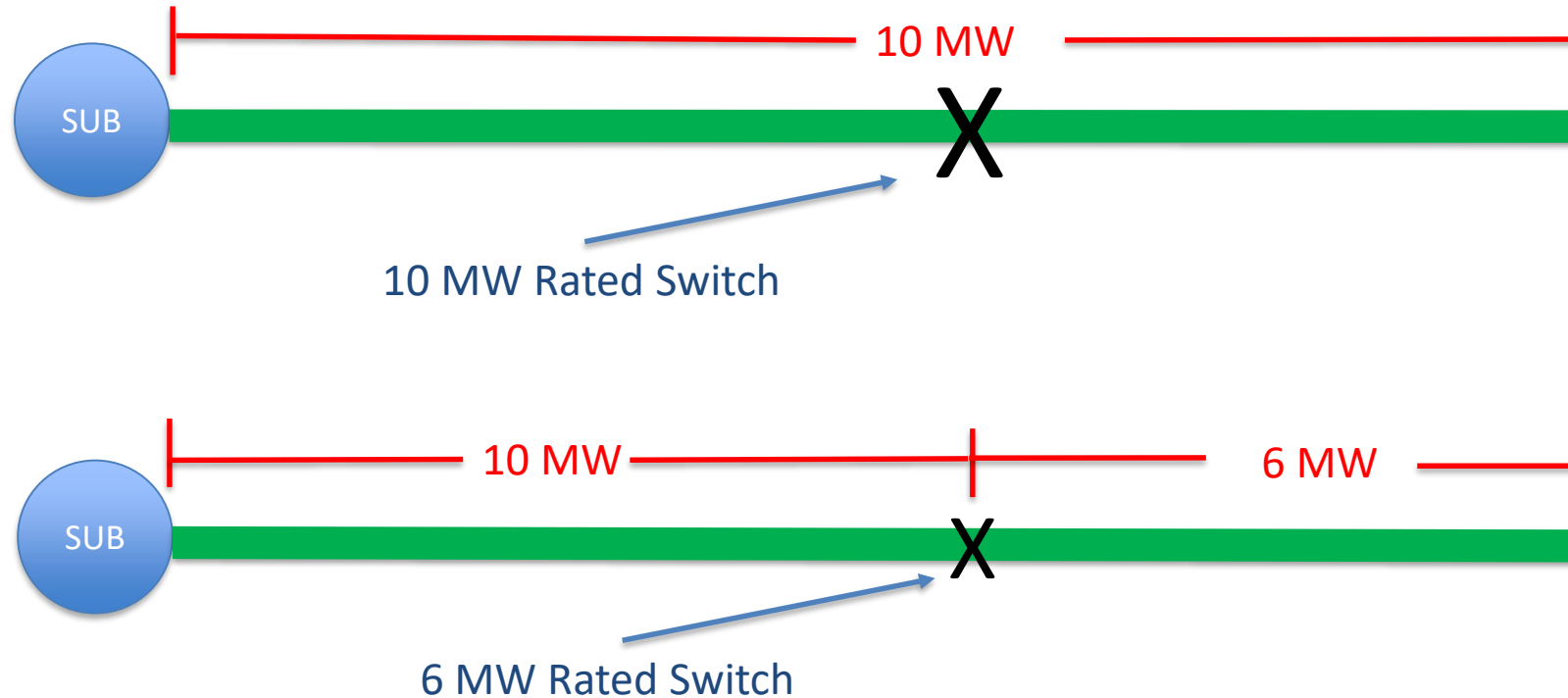
Item 17 – Downsizing Equipment

- Downsizing equipment can lead to a choker situation reducing load across the entire circuit



Item 17 – Downsizing Equipment

- Downsizing equipment can lead to a choker situation reducing load across the entire circuit



Integration Capacity Analysis Working Group

October 17, 2017

In-person meeting

drpwg.org

Agenda

Time	Topic
9:00 – 9:20	A. Intros, review schedule and deadlines
9:20 – 10:45	B. Group III topics on IT requirements for data sharing, access to market sensitive information, and expanding the functionality and range of data displayed on ICA maps Review of ICA webinar feedback on usability of downloadable data and maps
10:45 – 11:00	C. Break
11:00 – 11:20	D. Voltage regulating devices
11:20 – 11:40	E. Load shape development methodologies
11:40 – 12:00	F. Incorporation of DER growth scenarios
12:00 – 12:30	G. Validation, independent verification, and QA/QC
12:30 – 1:30	Break for lunch
1:30 – 3:30	H. Discussion on ICA planning use case Review of stakeholder proposal on policy use case and discussion on methodology for distribution capacity planning use case

ICA and LNBA Working Group Background: June 7 ACR

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Avoid late substantive additions that create contention and controversy during the drafting and editing of the Final Report.

Project plan: Key points

Main idea: All substantive proposals, recommendations, arguments, alternative recommendations, counter-arguments, analyses, and discussion ideas are submitted *in writing* prior to beginning the Final Report drafting process in early December.

The Final Report will consist solely of content drawn from previous written submittals.

The Review/Edit process will primarily be an opportunity for stakeholders to suggest *clarifications*. Any request for content additions must reference a previous written document submitted to MTS.

Upcoming WG meetings: focus is on areas where additional consensus is likely to be achieved

Remaining Schedule and Deadlines

10/13: Written comments on Group II proposals due

10/16: LNBA Working Group meeting

10/17: ICA Working Group meeting

10/20: Group III/IV written proposals due

10/27: Written comments on Group III/IV proposals due

10/31: Group II-IV status reports due

11/3: Final deadline for original proposals (all proposals containing new ideas, recommendations, visions, etc. distinct from other written proposals or comments.)

11/10: Final deadline for response to original proposals

11/15 – 11/16: November WG meetings

12/5: Final comment on November meeting discussions

12/11: First draft circulated

12/15: First round of edits

12/18-12/19: December WG meetings

12/27: Second draft circulated

1/3: Final round of edits

1/8: Report due

Scoping document: Data sharing, user friendliness, market sensitive information, IT requirements

Objective: Within the wider discussion around data access for ICA and LNBA, the ICA WG will specifically work on the means of making ICA information for user-friendly and accessible, including for nonengineers

Background: The ICA and LNBA WGs have worked on data sharing issues. The WGs developed a spreadsheet of data requests sorted by the following categories: 1) stakeholder type; 2) function requiring data; 3) rationale for function; 4) data types required; 5) rationale for data type; 6) confidentiality issues; 7) data availability; 8) alternative data sources; and 9) scope.

As part of the interim long-term refinement report, WG members identified the following issues for discussion: a) 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 such as the IDER proceeding; b) 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; c) Further refining the data access template; d) Develop ways to make ICA information more user-friendly and accessible, including for non-engineers (e.g., community planners, etc.); and e) Understand capacity and means to share market-sensitive information (e.g., type and timing of the thermal, reactance, or protection limits associated with the hosting capacity on each line)

Scoping questions:

- i) What does a more “user friendly” ICA look like, and which users would this include? ii) Does accessibility include both data access (such as available downloadable data) and overall public access? What useful formats should the downloadable data be provided? What changes would be made to make a public ICA portal more easily accessible?

Scoping document: Interactive ICA maps

Objective: The ICA WG will work to determine what improvements may be made to the ICA maps developed through Demo A to make them more interactive while maintaining usability.

Background: The IOUs have published the results of Demo A as additional layers within existing respective Renewable Auction Mechanism (RAM) maps. ICA results and load profiles are also published and available on the Commission's DRP webpage. The WG will first review the ICA maps published through Demo A to determine what improvements could be made to existing maps, including reducing overlap and ensuring a user-friendly interface. The IOUs have suggested proposed updates to the maps that could improve their interactive capabilities, as well as potential challenges with publishing large amounts of data on the map, which will require significant computation resources, and may take the user longer to load the information or navigate through map options, such as by DER growth scenario or by reverse flow options. Additional development of interactive ICA maps will first require an understanding of IT requirements and the benefits of increasing data directly visualized onto ICA maps.

Scoping questions:

- i) What are the compared benefits of additional data displayed in an interactive layer versus through downloadable files? ii) What are the additional IT requirements necessary for expansion of ICA heat maps?

IT requirements for data sharing, access to market sensitive information, and expanding the functionality and range of data displayed on ICA maps

- Review of ICA webinar and feedback on usability of downloadable data and maps
- Over 100 participants, and a wide range of DER providers represented
- Questions and comments on:
 - Efforts to standardize the map interface across all of the IOUs
 - How uniform generation and uniform load ICA is represented
 - How are queued interconnection projects shown
 - Whether it is possible to download shapefiles
 - Potential development and availability of API
 - Clarifying questions on the ICA translator
 - Load profiles display standardization
 - Where to find the specific criteria violations and which represents the primary limitation should be more clearly represented
 - Color key should be uniform in both color and value across IOU maps
 - Clarify on map how frequently they are updated, and date of last update



Integration Capacity Analysis (ICA) – Working Group

IOU Slides

October 17, 2017

Scoping Item Group III- Item B

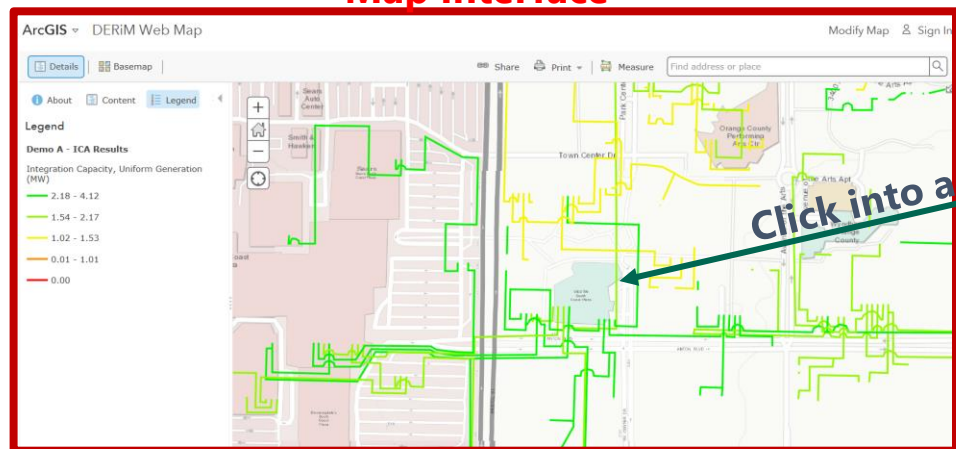
Scope - Group III – Item B

Item B: Ways to make ICA information more user-friendly and easily accessible
(data sharing)

Mapping & Data Information For Demo A (SCE)

<https://www.arcgis.com/home/webmap/viewer.html?webmap=e62dfa24128b4329bfc8b27c4526f6b7>

Map Interface



ICA Values

Demo A - ICA Results: Sunflower	
Circuit	Sunflower
Section ID	qhj99a0zz9a_j0i91\$6v10za-i_j0i91
Voltage (kV)	12.00
Substation	Fairview 66/12
System	Johanna 220/66 System
Integration Capacity, Uniform Generation (MW)	2.55
Integration Capacity, Uniform Load (MW)	1.51
Integration Capacity, Typical PV System (MW)	5.75
DERim User Guide	More info
DERim WebApp (Load Profiles)	More info
DRP Demo Results Library	More info

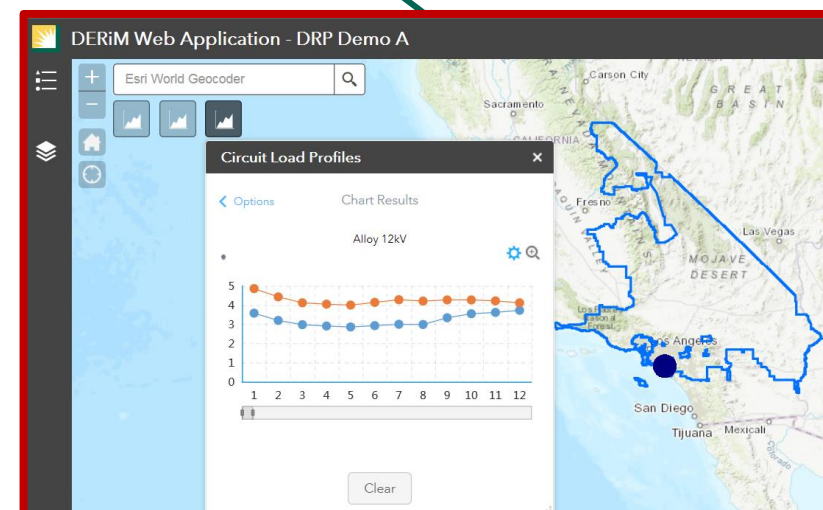
ICA translator

Southern California Edison ICA Translator V1.0									
Enter Agnostic Hourly ICA Value					Uniform Load				
Hour	Min	Max	Min	Max	Min	Max	Min	Max	Min
1	165.24	224.33	165.2	224.3	214.6	291.3	280.1	380.2	739.4
2	147.73	204.63	147.7	204.6	167.9	232.5	335.8	465.1	739.4
3	137.88	190.4	137.9	190.4	143.6	198.3	475.4	656.6	739.4
4	134.6	187.12	134.6	187.1	136.0	189.0	739.4	949.2	739.4
5	132.41	184.93	132.4	184.9	132.4	184.9	739.4	949.2	739.4
6	135.69	191.5	135.7	191.5	142.8	201.6	739.4	949.2	739.4
7	139	198.09	139.0	198.1	165.5	235.8	739.4	949.2	739.4
8	138.16	194.07	138.2	194.1	201.7	282.6	739.4	949.2	739.4

Detail ICA Information

Demo A - Integration Capacity Analysis	
ICA Translator	
Load Profiles & Customer Type Breakdown	
Detailed ICA Results	
Demo A ICA Results - Alloy 12 kV	
Demo A ICA Results - Aluminum 12 kV	
Demo A ICA Results - Anahurst 12 kV	
Demo A ICA Results - Aquifer 12 kV	
Demo A ICA Results - Aurora 12 kV	
Demo A ICA Results - Begonia 12 kV	
Demo A ICA Results - Billings 12 kV	
Demo A ICA Results - Bingo 12 kV	
Demo A ICA Results - Bismuth 12 kV	
Demo A ICA Results - Bullpup 12 kV	

Load Profiles



Item B: Ways to make ICA information more user-friendly and easily accessible (data sharing)

Depending on vendor capability, financing support and customer needs, the ICA interface tool may be enhanced to provide better search capabilities and more user-friendly access to data. These plans would be finalized based on user feedback, capability and financing support.

DERiM and ICA

DERiM and Integration Capacity Analysis

DERiM allows users to interact with SCE's ICA results and find locations that have minimal potential of triggering costly distribution upgrades

Search

Users can search for project sites using addresses

Filter

Users can filter for circuitry that has appropriate Integration Capacity

Toolbox

Users can use ArcGIS's toolbox to measure and edit symbology

SCE Service Territory: 4,790.69	
Existing Generation (MW)	4,790.69
Queued Generation (MW)	1,966.70
Total Generation (MW)	6,757.39
Projected Load (MW)	22,603.00

Export Data

Users can export data to have offline access to the datasets

Basemaps

DERiM provides 12 different basemaps for users to enable

Free Account

Users can access DERiM free of charge

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Integration Capacity Analysis (ICA) – Working Group

IOU Slides

October 17, 2017

Scoping Item Group III- Voltage Regulating Devices

Scoping Item Group III- Voltage Regulating Devices

Scoping Item Group III- Voltage Regulating Devices: If the commission authorizes the IOUs to model voltage regulating devices as they did in Demo A in the initial system wide ICA rollout, the ICA working group should work with software vendors to include this functionality as a long term refinement topic.

- The commission did approve the IOUs to model the voltage regulator devices in the initial system-wide rollout as it did for Demonstration Project A
- The IOUs are currently working with software vendors to incorporate this function as part of the software modeling tools.
- The IOUs will report progress of this work in the system implementation Interim Reports
- System implementation of this functionality should be done accounting for computing power and ability to meet the needs of ICA updates.



Integration Capacity Analysis (ICA) – Working Group

IOU Slides – Load Shapes

October 17, 2017

Scoping Item Group IV- Item 9

Load Shapes for ICA

- From the ICA WG scoping document:

Objective: The WG will revisit the means the IOUs develop load shapes, first fully understanding the differences and tradeoffs between those methods used in Demo A, then discussing proposed improvements.

Scoping Questions: The WG discussed these methodologies in some detail, and agreed upon their use in Demo A, but would like to further explore reasons for divergence in methodology, as well as trade-offs between methods, as part of long-term refinement.

Load Shapes for ICA

- The IOUs utilize similar approach
- Customer Load profiles
 - Developed from AMI Data
 - Aggregated at the service transformer
- Circuit Load Profiles
 - Developed from SCADA data

Load Shapes for ICA – IOU comparison

ITEM	SCE	PG&E	SDG&E
Customer Load Profile	<ul style="list-style-type: none">Created directly from individual AMI data	<ul style="list-style-type: none">Created directly from individual AMI data	<ul style="list-style-type: none">Created using AMI dataAggregated by customer class
Service Transformer Load Profile	<ul style="list-style-type: none">Aggregation of customer profiles	<ul style="list-style-type: none">Aggregation of customer profiles	<ul style="list-style-type: none">Aggregation of customer profiles
Circuit Load Profile	<ul style="list-style-type: none">Created from SCADA data	<ul style="list-style-type: none">Created from SCADA data	<ul style="list-style-type: none">Created from SCADA data
Substation Load Profile	<ul style="list-style-type: none">Created from SCADA data	<ul style="list-style-type: none">Created from SCADA data	<ul style="list-style-type: none">Created from SCADA data



Integration Capacity Analysis (ICA) – Working Group

IOU Slides – DER Growth

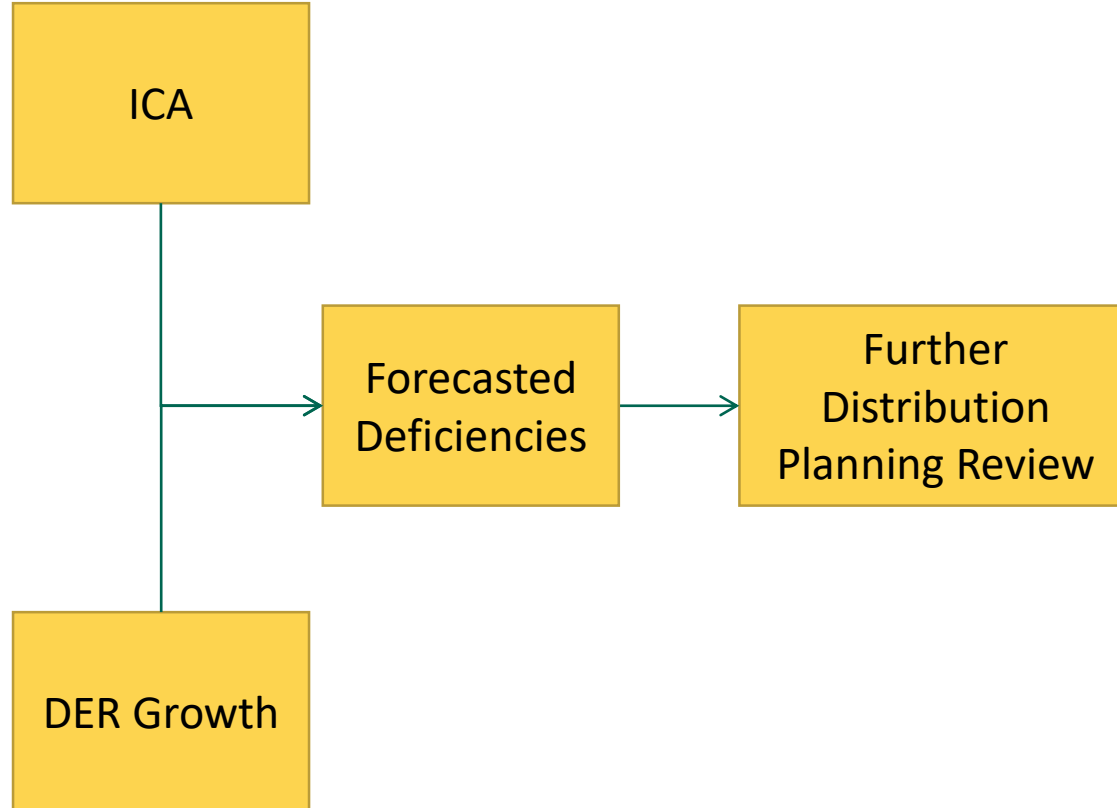
October 17, 2017

Scoping Item Group III- Item 3

Item 3 – DER Growth

- Item 1 established some of the framework of which this would work and what technical considerations have to be considered. The details of the three points can be found in the Item 1 proposal and will follow the discussion there. They are:
 1. Granularity of DER Growth Forecast projections
 2. Application of ICA results in comparison to DER Growth Forecast
 3. Which DER Growth to consider due to granularity and applicability in tariffs
- Conclusion and Next Steps
 - Use the Track 3 DER growth scenarios to compare/utilize with ICA to determine forecasted deficiencies to host DER for further study as outlined in Item 1
 - Do not use wholesale growth in analysis due to (1) lack of granularity/certainty of placement and (2) rules require them to mitigate and pay for the issues that they cause

Considering DER Growth with ICA for Planning



ICA and Growth will find deficiencies

- ICA will provide the available capacity
- Comparing with the DER growth will determine when and where a deficiency is expected

ICA does not determine solutions

- Results from this deficiency analysis will be provided to use for the rest of the planning process
- Solution sets for these deficiencies will be coordinated with other planning efforts and planned system upgrades



Integration Capacity Analysis (ICA) – Working Group

IOU Slides – QA and QC

October 17, 2017

Scoping Item Group IV- Item G

Item G – Define QA and QC Measures

- Much overlap with Items 3 and F
- Utilize efforts in Item F to evaluate effectiveness of results within interconnection process
- Utilize efforts in item 3 and F to compare and validate results across tools and stakeholders to provide a common level of assurance and collective consensus
- Interconnection QA/QC will be defined as effectiveness in providing appropriate answer to pass screens when compared to the results of the normal interconnection study process
- Planning QA/QC will be defined as the validation and replicability of results within different tools and by stakeholders



Integration Capacity Analysis (ICA) – Working Group

IOU Slides

October 17, 2017

Scoping Item Group IV – Item F

Item F - ICA Validation Plans and Independent Verification

- Align and Coordinate with Items 4, 8, and 9
- Continue to validate through comparative assessments across tools (Item 4)
- Evaluate effectiveness in streamlining interconnection process when implementing in Rule 21
- Continue to drive alignment on IEEE 123 feeder (Item 8) and use learnings to inform validation and comparison across tools and stakeholders
- Continue alignment of use of hourly metering data to reduce the main driver of uncertainty in the model (Item 9)



Integration Capacity Analysis (ICA) – Working Group

IOU Slides – Planning Use Case (Topic #1)

August 15, 2017

Scope of the Planning Use Case

- What is it used for?
 - The utilization of ICA in the planning use-case is intended to assist with other planning and analysis techniques used by engineers
 - Helps find areas that may need proactive actions or investments to accommodate growth of retail DG
- What does it calculate?
 - Utilization of ICA in the planning use-case helps determine violations caused by the forecast
 - Timing and category components in ICA might help figure out what types of violations need to be addressed but not necessarily how to fix them
- What does not it calculate?
 - Utilization of ICA in the planning use-case does not determine the final solution needed to fix the violations identified
 - The utilization of ICA in the planning use-case must be coordinated with the overall system planning assessment to determine the final DER system upgrades needs
- Scope
 - Should align with normal planning cycle and be performed once a year
 - 1-5 year analysis including load growth and DER growth

Large Single Interconnection versus Small Dispersed Interconnection

- Planning requires us to evaluate the aggregate impact of many new DER versus a single DER at a specific location
- ICA so far has had a “interconnection” focus which evaluates DG impacts at single interconnection location(node) based on existing conditions
- The planning use case of ICA needs similar thinking to load planning where general overall growth is considered versus one location at a time
 - Not as easy given that every customer doesn’t have DG so applying growth factors is not as appropriate
- Ways to consider this
 - **Stochastic Placement:** Stochastically placing forecasted DG across circuit and then performing power flows to identify the violations created by the forecasted DER.
 - **EPRI DRIVE:** Applying Weibull distribution algorithms to equations to account for dispersion

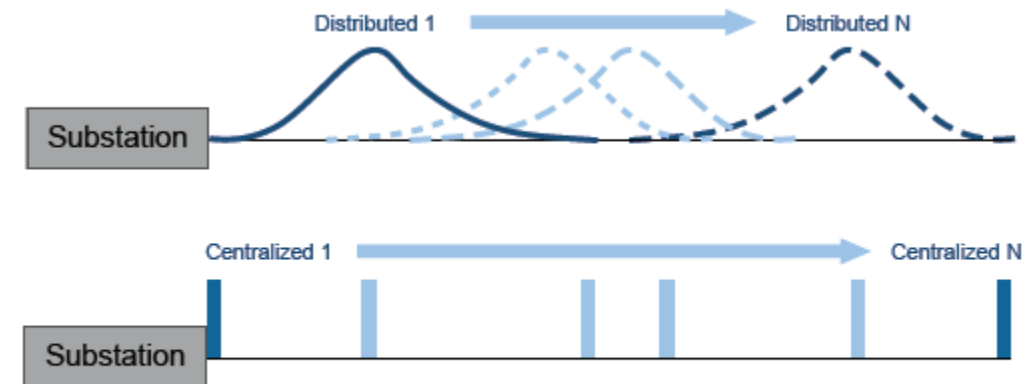
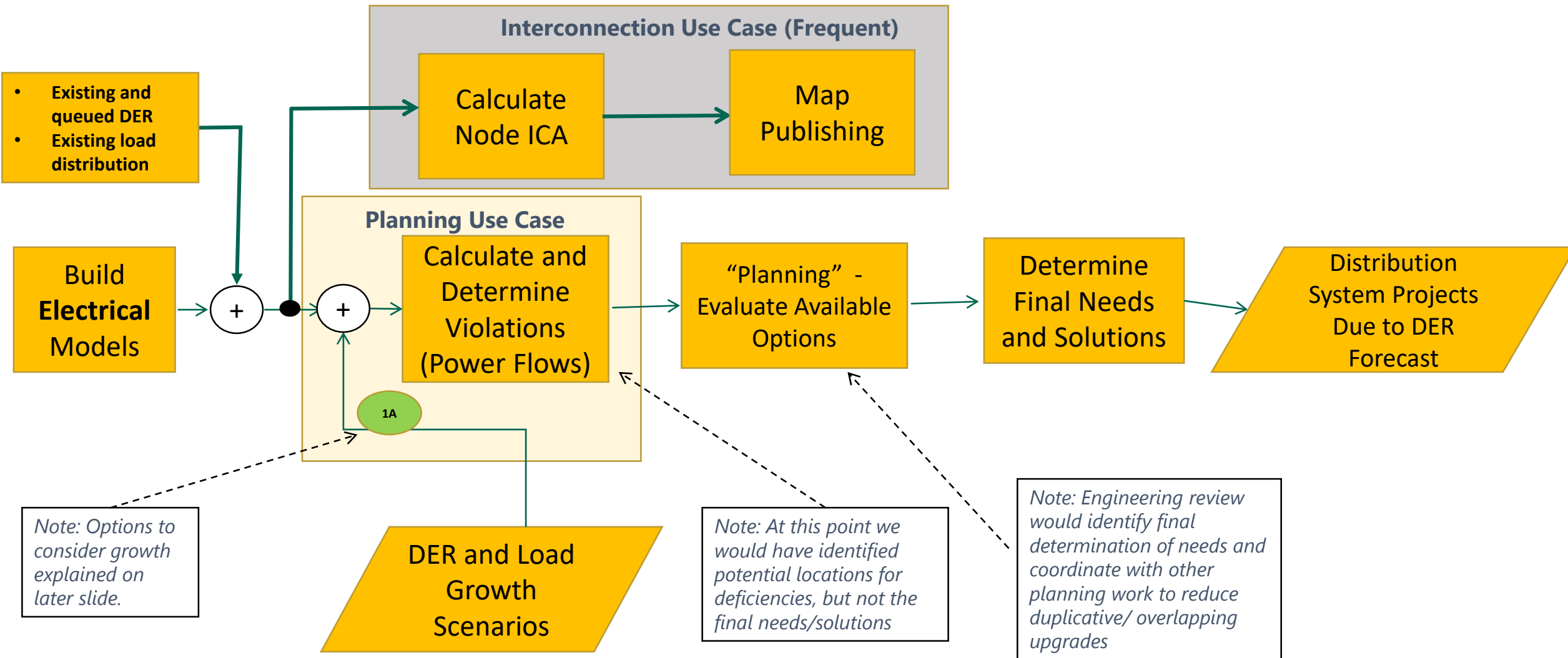


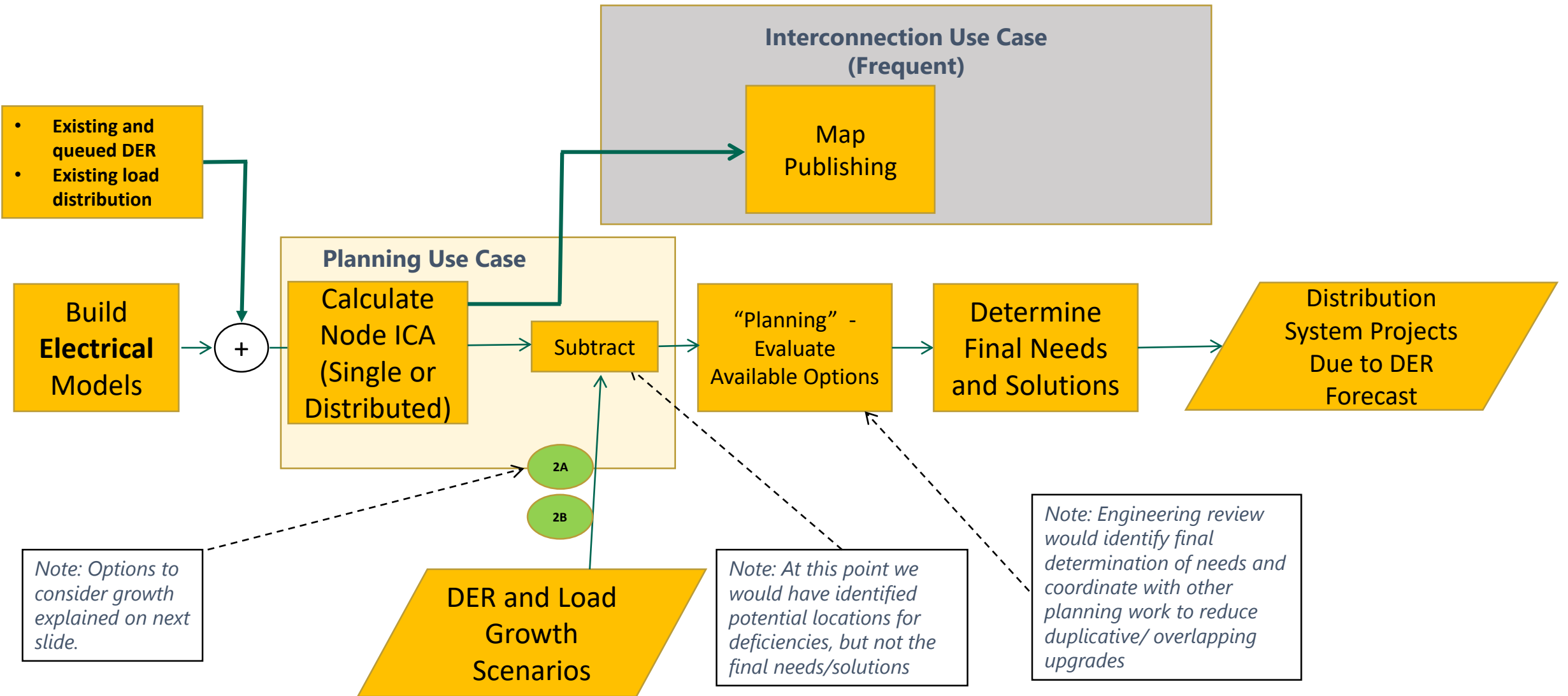
Figure 6 – Subset of DER Scenarios Analyzed in the Streamlined Analysis

Source: EPRI, INTEGRATION OF HOSTING CAPACITY ANALYSIS INTO DISTRIBUTION PLANNING TOOLS

Using ICA to determine Grid Needs for DER Growth

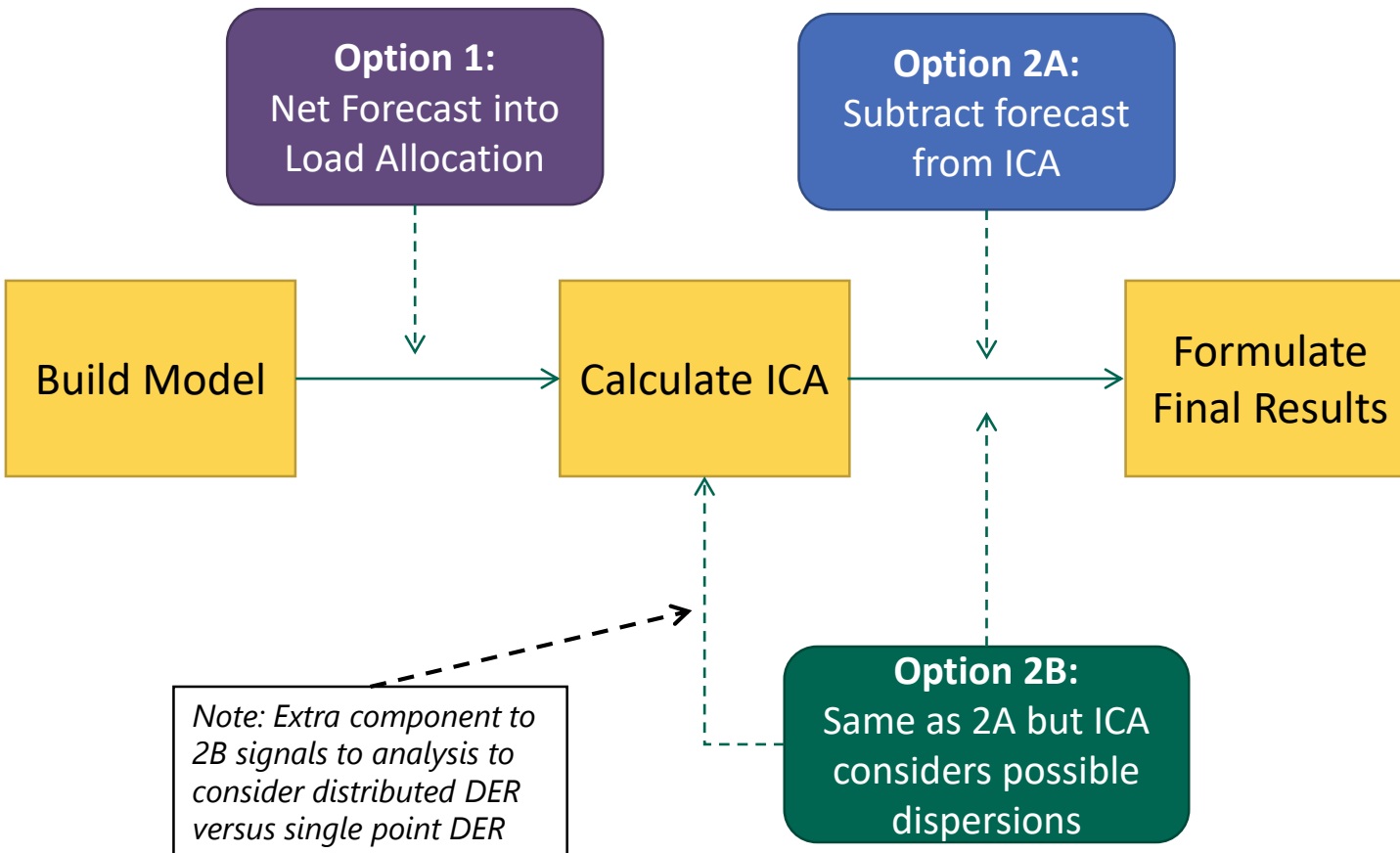


Using ICA to determine Grid Needs for DER Growth



How to Consider DER Growth in ICA

NOTE: DER Growth would be by feeder and thus makes specific line section ICA difficult to consider



1. Net Forecast into Load Allocation

- DER growth netted into the load allocation before ICA is calculated
- Attempts to more directly account for growth, but only accounts for a peanut butter distribution of DER

2A. Compare Growth to ICA

- Option A utilizes current output of ICA evaluating single point ICA
- The easiest to perform, but results don't really have any consideration of dispersion of DER on circuit

2B. Compare Growth to modified ICA

- utilizes an ICA output that has considered the distribution of DER in the analysis
- Would require adjustments to ICA for considering small dispersed DER versus large single point DER