JOINT UTILITIES OF NEW YORK

Hosting Capacity Stakeholder Webinar

(December 4, 2019)

Engagement Group Ground Rules*

- All stakeholder engagement (Advisory Group and Engagement Group) meetings, webinars and information exchange are designed solely to provide an open forum or means for the expression of various points of view in compliance with antitrust laws.

- Under no circumstances shall stakeholder engagement activities be used as a means for competing companies to reach any understanding, expressed or implied, which tends to restrict competition, or in any way, to impair the ability of participating members to exercise independent business judgment regarding matters affecting competition or regulatory positions.

- Proprietary information shall not be disclosed by any participant during any stakeholder engagement meeting or its subgroups. In addition, no information of a secret or proprietary nature shall be made available to stakeholder engagement members.

- All proprietary information which may nonetheless be publicly disclosed by any participant during any stakeholder engagement meeting or its subgroups shall be deemed to have been disclosed on a non-confidential basis, without any restrictions on use by anyone, except that no valid copyright or patent right shall be deemed to have been waived by such disclosure.

- AG & EG discussions will be open forums without attribution and no public documents by the AG or EG will be produced unless publication is agreed upon by the group.

**Ground Rules adapted from the JU Advisory Group*

Agenda

1. Introductions
2. Addressable Items in the Near-term
3. Hosting Capacity Data Validation Efforts & EPRI DRIVE Example
4. Proposed Enhancements for Further Discussion
5. Longer-term Items

Meeting Goals

- Bring the Industry Response document to the forefront of the discussion – these slides are intended to capture that feedback and provide suggested action when possible.
- Discuss what enhancements the JU can provide with the currently available data in the near-term.
- Build a common understanding of the priority items requiring further development/implementation in the hosting capacity displays.
- Begin to set a timeline for Stage 3.X development and implementation.
- Build on the industry response document to develop a JU survey on proposed prioritization and additional feedback from a broader audience.

Addressable Items in the Near-term

- Stakeholders have provided well developed suggestions and descriptions of the many potential enhancements to the hosting capacity displays.

- While some items still require further discussion, the JU agree with many of the suggestions raised and propose the following items where near-term progress can be made:
  a. EPRI DRIVE Utility Inputs, Analyses Used, and Study Parameters Transparency
  b. Better Communication of Available Reference Materials and Supporting Documentation
  c. Upstream Substation/Bank-Level Constraints
  d. Circuit Notes/Annotations (previously listed as Circuit Configurations)
  e. Additional Map functionality (downloadability/filterability)

DRIVE Utility Inputs, Reference Materials & Supporting Documentation

- Developers made clear that greater transparency of the analysis and better communication of supporting materials is a value add to their business case.

- To provide stakeholders with a better understanding of the hosting capacity analyses, the JU will provide supporting material that includes:
  - A description of analyses conducted with useful links to supporting documentation e.g. HCA methodology and assumptions
  - FAQs
  - Release notes on how Stage 3.0 differs from previous versions and introductory guidance material
  - Summary tables of DRIVE analysis criteria by utility with supporting definitions and threshold settings
  - Recordings of Stage 3.0 user demos

Upstream Substation/Bank-Level Constraints

- Developers' main request relating to substation/bank-level constraints is focused on their ability to identify the potential need for substation upgrades.

- With more information, a developer could avoid proposing projects where the supplying substation's saturation limit has already been exceeded.

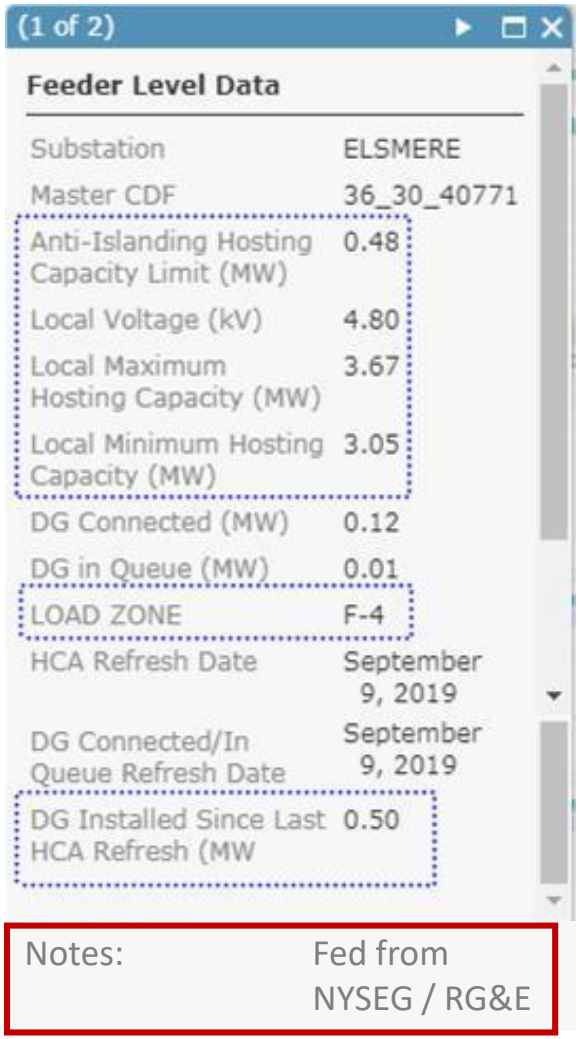
- Developers suggest the JU provide the following list of substation constraints:
    a. Substation Bank/Transformer Nameplate/Thermal-Limit
    b. Substation 3V0 Protection Threshold
    c. Substation Regulator/LTC Backfeeding Protection Limit
    d. Substation Bus Voltage Fluctuation Limit

Circuit Notes (previously listed as Circuit Configurations)

- Stakeholders suggested that annotations on the map would be helpful in the quoting process to budget in additional funds or prepare for a difficult and costly interconnection.

- The Joint Utilities can add annotations to note specific circuit configurations / constructions where that additional clarity is most valuable.

- Highlighting the utility contact info to answer specific questions may also help resolve this issue.



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Additional Map functionality (downloadability/filterability)

- The JU suggest more discussion is needed on prioritization for development and implementation of the multiple elements requested.

- In the interim, the JU can provide downloadable feeder-level summary (.csv or .xlsx) that includes data elements currently available in the pop-ups.

- The downloadable feeder-level data is a step towards enabling developers to “search and filter” the HCA data to help identify, compare and evaluate appropriate sites for the type of project they want to build.

B	C	D	E	F	G	H	I	J	K	L	M
Substation	Feeder	Feeder Nominal Voltage (kV)*	Max 3-Ph HC (MW)	Min 3-Ph HC (MW)	Anti-Islanding Hosting Capacity Limit (MW)	Feeder DG Connected (MW)	Feeder DG in Queue (MW)	Feeder DG Connected Since Last HCA Refresh	Load Zone	DG Connected/In Queue Refresh Date	HCA Refresh Date
QUEENSBURY	36_38_29557	13.2	9.2	0.6	0.81	0	0	0	F-4	29-Sep-19	30-Sep-19
121 CLINTON ST	36_01_12161	4.8	1.9	0.3	0.18	0	0	0	A-1	29-Sep-19	30-Sep-19
124 ALMEDA AVE	36_01_12462	4.16	2.4	0.5	0.33	0.03501	0.0076	0	A-1	29-Sep-19	30-Sep-19
124 ALMEDA AVE	36_01_12463	4.16	2.55	2.55	0.13	0	0	0	A-1	29-Sep-19	30-Sep-19
124 ALMEDA AVE	36_01_12464	4.16	2.38	1	0.3	0	0.66	0	A-1	29-Sep-19	30-Sep-19

Proposed Near-Term Enhancements

- The JU can provide:
  - Supporting material on the DRIVE tool inputs by utility, and additional user reference materials on the Stage 3.0 displays
  - Downloadable feeder-level summary data (.csv or .xlsx) that includes the data elements currently available in the pop-ups

- The JU can add the following items to the data pop-ups:
  - Substation Bank/Transformer Nameplate/Thermal-Limits
  - Substation 3V0 Protection Thresholds
  - Annotated notes for additional circuit specific info

Hosting Capacity Data Validation Efforts / EPRI DRIVE Example

- The JU agree with the importance of displaying accurate HCA data.
- EPRI has made significant efforts to validate the results against traditional impact study methods as well as other hosting capacity methods.
- The circuit modeling input data is what typically requires the most data validation.
- As a result, the following data validation efforts are performed by each of the utilities before each HCA refresh:
  - Circuit analysis and data review for each feeder
  - Comparison of hosting capacity values from previous years
  - Comparison of hosting capacity values due to DRIVE updates
  - Review of HCA values and criteria limitations as a JU

Distribution Resource Integration and Value Estimation (DRIVE)

JU Overview

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2019 December 4

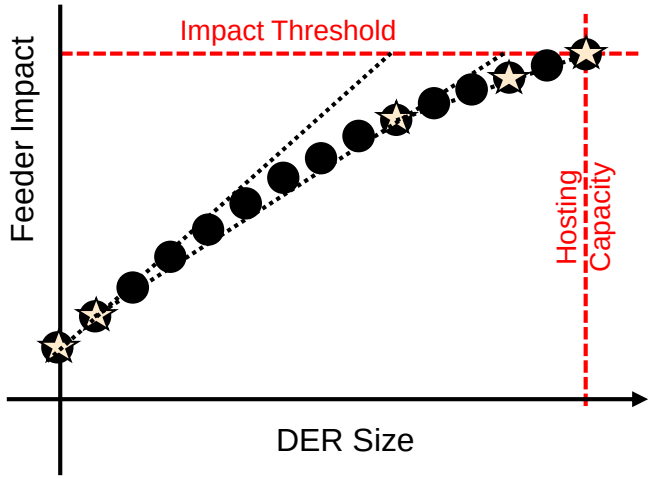
DRIVE

DRIVE Members

1. TVA
2. Xcel Energy
3. Eskom
4. SRP
5. Hydro1
6. ESB Networks
7. CenterPoint
8. Iberdrola/Avangrid
9. CFE Mexico
10. Taiwan Power
11. SMUD
12. FirstEnergy
13. Great River Energy
14. Ameren
15. Lincoln Electric
16. Central Hudson
17. Alliant Energy
18. Entergy
19. Southern Co
20. National Grid
21. Pacific Gas & Electric
22. Exelon
23. Portland General
24. ConEd/O&R
25. DTE Energy
26. Idaho Power
27. APS
28. Great Plains Energy
29. Eversource
30. MN Power
32. PNM
33. KEPCO
34. Consumers Energy
35. Puget Sound Energy

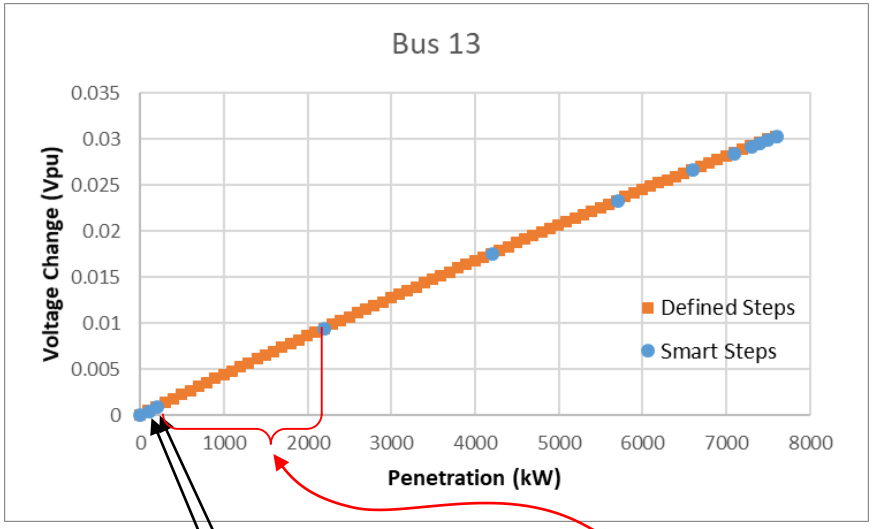
Algorithm to Expedite Analysis

- Intelligent increment of DER
  - ☆ Penetration Increments Analyzed with Impact-based Routine
  - ····· Projected Impact vs DER size
  - ● All Penetration Increments Analyzed



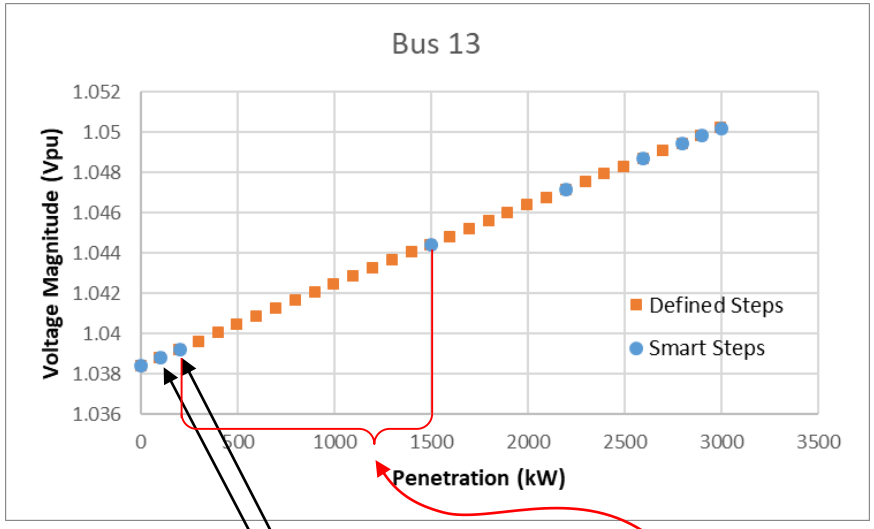
$$SmartStep = min\left(\frac{ImpactThreshold - Impact_{new}}{Impact_{new} - Impact_{old}} \times (Pen_{new} - Pen_{old}) \times StepAdjustment, MaxStep\right)$$

Smart Penetration Steps



200 kW -> 0.000874 Vpu
100 kW -> 0.000438 Vpu
StepAdjustment = 50%
MaxStep = 2 MW

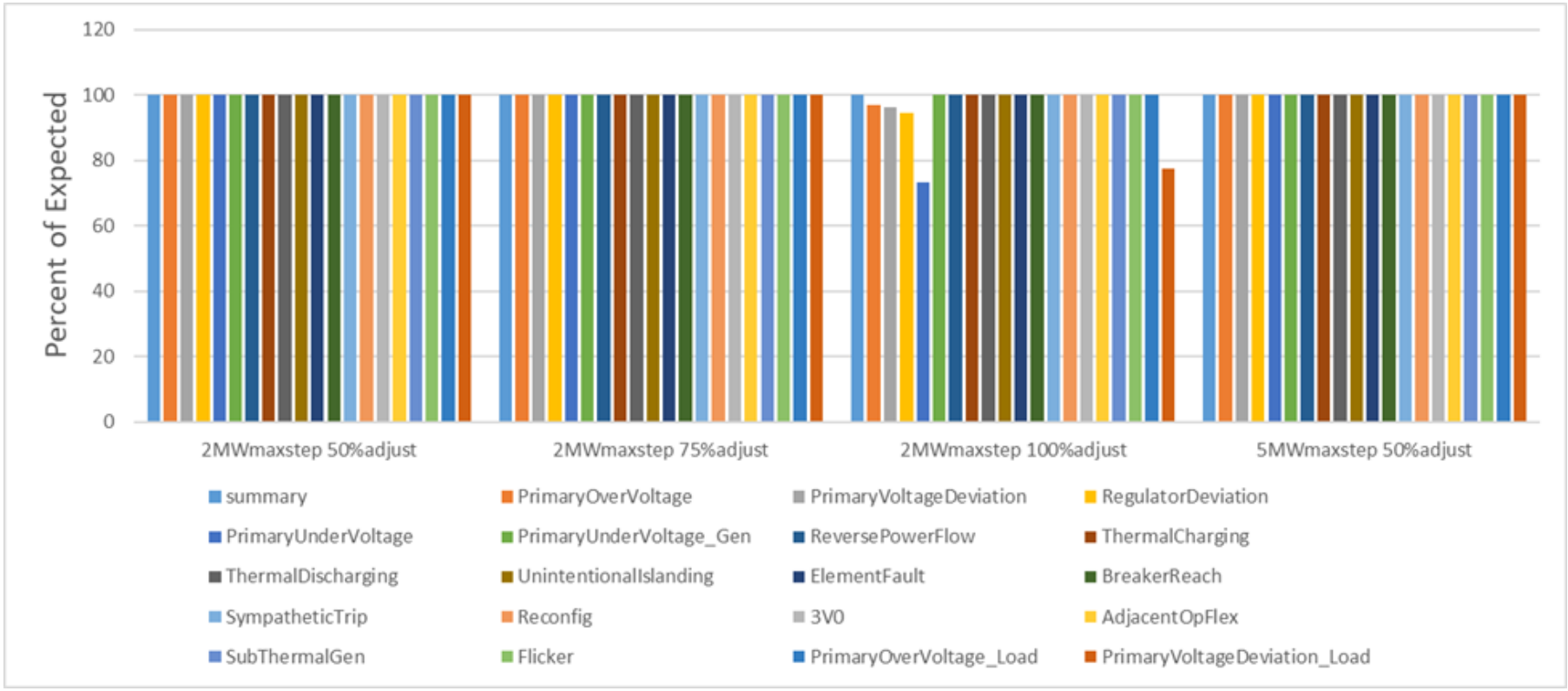
$$SmartStep = min\left(\frac{0.03 - 0.0009}{0.0009 - 0.0004} \times (200 - 100) \times 0.5, 2000\right) = 2000$$



200 kW -> 1.039217 Vpu
100 kW -> 1.038809 Vpu
StepAdjustment = 50%
MaxStep = 2 MW

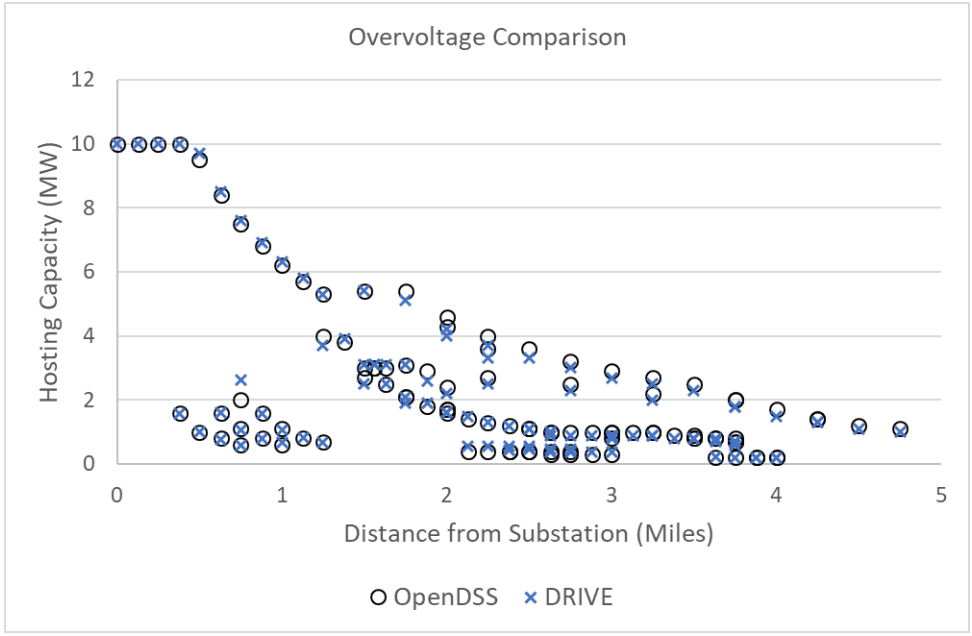
$$SmartStep = min\left(\frac{1.05 - 1.0392}{1.0392 - 1.0388} \times (200 - 100) \times 0.5, 2000\right) = 1300$$

Smart Penetration Step Algorithm Characteristics

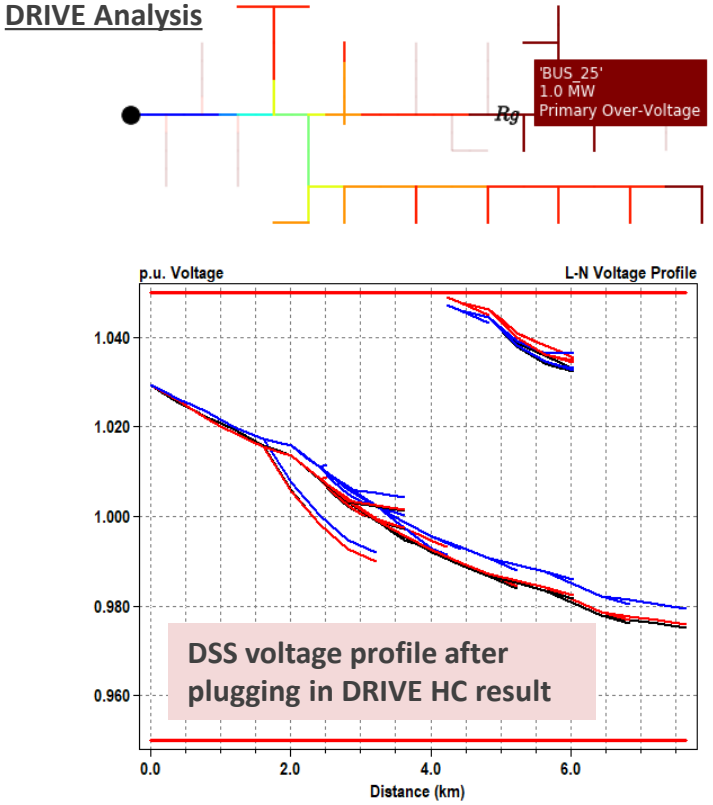


Overvoltage Validation

OpenDSS HC Routine



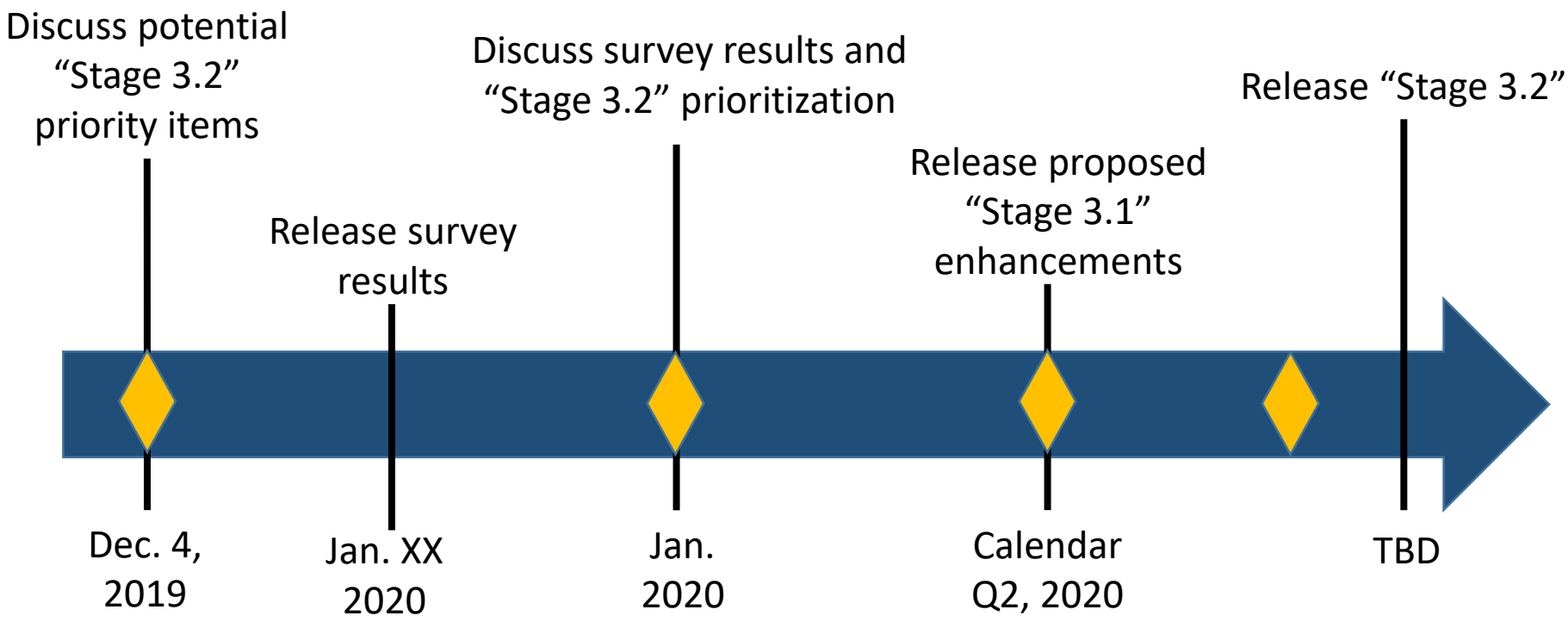
DRIVE Analysis



Together...Shaping the Future of Electricity

Future Meetings / Next Steps

The draft timeline below is intended to facilitate discussion on proposed sequencing and timing



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Stakeholder engagement meeting

NYSEG nationalgrid Orange & Rockland Rockland Electric Company conEdison Central Hudson RG&E

Proposed Enhancements for Further Discussion

- The Joint Utilities are seeking further input from stakeholders on the following items in support of development and implementation of future 3.X releases:
  a. Increased Analysis Refresh Rate
  b. Hosting Capacity Analysis for other DER Types (Storage, CHP, EVs, Hybrid Solar + Storage)
  c. Hosting Capacity Analysis Criteria Violation Transparency
  d. Time-Varying Hosting Capacity (increased temporal granularity)

Increased Analysis Refresh Rate - Industry Response

- **Industry Definition:** HCA should ideally be conducted on a weekly basis, or monthly basis at a minimum. The "update" does not necessarily require updating every circuit each run, only those that have changed (either due to known changes in system equipment or configuration, queued or interconnected DER, and known load changes beyond base assumptions)

- **How This Would Be Used:** In order for the HCA values to be used for interconnection purposes it needs to reflect current system conditions, too much changes in a year's time.

- **Suggested Action:** Discuss what would be involved in achieving a weekly and monthly refresh. Utilities should identify what additional resources would be required and any information updates that might be necessary to achieve a more frequent refresh.

Hosting Capacity Analysis for Other DER Types - Industry Response

- **Industry Definition:** Currently, the HCMs only determine the limits of how much generation can be accommodated on a particular circuit segment. In order for this development tool to be useful for other types of DER that act as loads (i.e. energy storage, EV charging stations, etc.), the hosting capacity analyses must be extended to include load limits on a line segment. There must also be extensive discussions between the JU and stakeholders on the differences to HCA input parameters between DERs that act as generators versus those that act as loads.

- **How This Would Be Used:** By being able to identify the hosting capacity for both load and generation DERs at particular points on the utility grid, developers from all backgrounds will be able to use the HCMs to find sites with adequate capacity for their type of system.

- **Suggested Action:** Add HCA for other DER types to the maps and downloadable data.

Hosting Capacity Analysis Criteria Violation Transparency – Industry Response

- Stakeholders suggested the JU provide all thresholds determined by the DRIVE tool in the hosting capacity maps after consulting with stakeholders on how best to display said information.

- The JU have concerns with providing the violation type for every threshold and line section as currently proposed.

- More than one violation type may exist in a single line segment and there are serious challenges with the feasibility of providing that level of detail in the displays.

- This item may be an instance where more data can lead to a greater potential for misinterpretation if used to extrapolate on assumed interconnection costs.

Time Varying Hosting Capacity – Industry Response

- **Industry Definition:** Aspects of the hosting capacity analysis (i.e. over/under-voltage, power quality, flicker, thermal constraints, etc.) can vary greatly depending on the load characteristics of a particular day. Typically, there are also seasonal load trends that also change hosting capacity significantly throughout the year.

- **How This Would Be Used #1:** Identify the hosting capacity for DER (both load and generation) at particular points on the system

- **How This Would Be Used #2:** Configure the map to be usable by the utility for distribution planning purposes such as identifying NWA locations or where proactive upgrades may be needed. with sufficient accuracy (for the technical criteria evaluated) that the results can be used to both inform and make interconnection decisions.

- **Suggested Action:** The Industry suggests that the JU perform 576 hourly analysis using the DRIVE tool. Below is a suggested roadmap in order to build the necessary database to perform such analyses.

Longer-term Items

- The JU noted the following items as longer term items to continue to consider in the context of the broader hosting capacity roadmap:
  a. Forecasted Hosting Capacity
  b. Dynamic Hosting Capacity
  c. Hosting Capacity Usability for Internal Tasks

Meeting Notes

December 4th Stakeholder Webinar Key Points of Discussion

- Stakeholders would like to see more specific points of discussion on each topic.
- On the supporting reference materials, items that were noted to be added as FAQs or for additional documentation on included:
  - How to identify the attribute table in the displays
  - Do the displays allow for searchability/filterability?
  - How are the results being displays validated by each utility?
- The survey is a good idea, but it should also consider the longer-term goals of the hosting capacity displays and not be structured in a way where the user must choose between options
- Stakeholders recommended more stakeholder engagement groups sessions to discuss proposed enhancements between releases.
  - For example, it'd be good to have another session between releases to view potential examples before going into full-scale implementation e.g. the January meeting before the Stage 3.1 release in March could include example data pop-ups for the new Stage 3.1 items.
- JU to upload the slides to the JU website with a summary of the major points of discussion.

Proposed Enhancements for Further Discussion

Topic	Discussion Points	Next Steps
Future Stakeholder Meetings	• Stakeholders explained that they'd prefer more stakeholder engagement groups sessions to discuss proposed enhancements before they are released e.g. review mock data pop-ups for proposed additions at the January meeting before the Stage 3.1 release in March. • Stakeholders agree there are near-term items to focus on, but it would also be valuable to include longer term items in the stakeholder meetings purview as well.	**OPEN** – The Joint Utilities will update the proposed stakeholder timeline and structure to account for that feedback.
Increased Analysis Refresh Rate	• Stakeholders explained their concerns with how the uncertainty of installed and queued DG impacts the results of the hosting capacity analysis over time. • Stakeholders recommended the JU provide more information on what constitutes a "significant change" for the increased analysis refresh and some examples of how often those significant changes occur. This will provide specific points of discussion and to help work through each of the potential challenges, e.g. the magnitude and frequency of DG installed and feeder circuit changes.	**OPEN** – The Joint Utilities will provide a proposed definition of what constitutes a significant change and will benchmark any supporting metrics to propose an increased analysis refresh frequency.

Proposed Enhancements for Further Discussion

Topic	Discussion Points	Next Steps
Circuit Notes / Annotations (previously listed as Circuit Configurations)	• In addition to providing mock-ups of proposed data pop-up updates, stakeholders requested more information be provided on the existing anti-islanding data pop-up item. • The group discussed that the utilities will implement an additional row for circuit notes / annotations, but developers should continue to recommend if a new note be added by initially reaching out to the individual utility referenced.	**OPEN** – The Joint Utilities will provide example data pop-ups for the proposed additional substation data pop-up items: Annotated notes for additional circuit specific info.
Upstream Substation/Bank-Level Constraints	• Stakeholders would like to see examples of what the proposed additional substation data pop-up information will look like for further discussion.	**OPEN** – The Joint Utilities will provide example data pop-ups for the proposed additional substation data pop-up items: Substation Bank/Transformer Nameplate/Thermal-Limits; and Substation 3V0 Protection Thresholds.

Proposed Enhancements for Further Discussion

Topic	Discussion Points	Next Steps
Additional Map Functionality	• Stakeholders are interested in understanding what the exact hurdles are to implementing: .gdb, .kml, .kmz, API integration, searchability and filterability to the displays. • Stakeholders suggested the JU review National Grid's current attribute table as a starting point for common implementation across utilities. Stakeholders also recommended the proposed downloadable data also include substation information. • In addition to the downloadable data, stakeholders noted the preferred method for filtering in the displays, would be to be able to filter circuits by a specific criteria and have only those circuits visualized in the displayed.	**OPEN** – The JU will review the additional or alternate file formats with their IT personnel as well as National Grid's attribute table to identify any technical challenges with implementing additional downloadability / filterability. The JU will also investigate providing downloadable information included in the substation data pop-ups as a .csv.

General Notes

Topic	Discussion Points	Next Steps
Hosting Capacity Data Validation Efforts	• Stakeholders requested more written information on the QA/QC process of the hosting capacity analysis and displays is conducted. Additional supporting information on QA/QC can help increase the developer community's confidence in the results.	**OPEN** – The Joint Utilities will prepare additional reference material to be included in the HCA supporting documentation aimed at addressing these concerns.
Stage 3.X Survey	• Stakeholders noted that the survey can help get input from a broader audience and with prioritization, but recommended the survey not be formatted in a way that requires the respondents to have to choose between options. • Stakeholders suggested the survey not be limited to only the most near-term enhancements, but to take a longer-term view so the feedback is helpful in developing the kind of roadmap that will continue to be helpful.	**OPEN** – The Joint Utilities will structure the survey to be sensitive to that feedback.

Action Items Back to Stakeholders

1. The Joint Utilities will update the proposed stakeholder timeline and structure to include additional meetings between releases.

2. The Joint Utilities will provide a proposed definition of what constitutes a significant change with any supporting metrics to an increased analysis refresh frequency. The Joint Utilities will provide example data pop-ups for the proposed additional substation data pop-up items:
    1. Substation Bank/Transformer Nameplate/Thermal-Limits;
    2. Substation 3V0 Protection Thresholds
    3. Annotated notes for additional circuit specific info.

3. The JU will review the additional and alternate file formats requested (.gdb, .kml, .kmz, and API integration) with their IT personnel as well as National Grid's attribute table to identify any technical challenges with implementing additional downloadability / filterability. The JU will also investigate providing downloadable information included in the substation data pop-ups as a .csv.

4. The Joint Utilities will prepare additional reference material to be included in the HCA supporting documentation aimed at addressing stakeholder requests for more supporting material on QA/QC practices, FAQs, user-demos, release notes, DRIVE criteria used in the analysis, etc.

5. The Joint Utilities will structure the survey to be sensitive to stakeholder feedback to allow for responses that help with prioritization without having to choose between equally important items.