White Paper

Where's the Value in Hosting Capacity Analysis?

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Executive Summary

Many utilities across the country are actively analyzing the hosting capacity of their systems. Many more are beginning to think about it. The key question for all concerned is: what value does this deliver for utilities, stakeholders and customers? And it's a good question, because it isn't always clear what outcomes hosting capacity enables and for whom.

To answer, utilities, regulators, and other market stakeholders should start with a focus on one thing: use case.

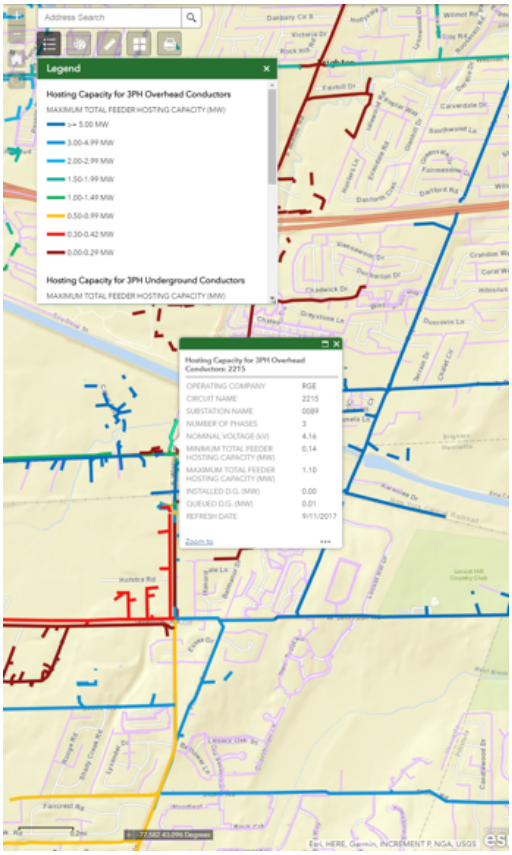
What is Hosting Capacity Analysis?

Hosting capacity analysis provides an estimate of the amount of DER that can be accommodated without significant system upgrades. Hosting capacity is one element of the type of integrated distribution framework we discussed in "On the Grid's Bleeding Edge: The California, New York, and Hawaii Power Market Revolution," "The Value in Distributed Energy: It's All about Location, Location, Location" and in our 2016 report on Integrated Distribution Planning in the Minnesota context.[1]

[1] Fine S, Robison M, Succar S.. The Value in Distributed Energy: It's All About Location, Location, Location. icf.com. https://www.icf.com/resources/white-papers/2015/value-in-distributed-energy. 2016.

Integrated Distribution Planning: Prepared for Minnesota Public Utilities Commission. energy.gov. https://energy.gov/sites/prod/files/2016/09/f33/DOE%20MPUC%20Integrated%20Distribution%20Planning%208312016.pdf. 2016.

EXHIBIT 1: NYSEG AND RG&E DISTRIBUTED INTERCONNECTION GUIDE MAP, ACCESSED OCTOBER 2017



Source: http://iusamsda.maps.arcgis.com/apps/webappviewer/index.html?id=2f29c88b9ab34a1ea25e07ac59b6ec56

Understanding the real value of the analysis requires a closer look at the intended objectives and the value proposition to stakeholders. It's important to note that we aren't talking about one methodology or one approach intended for a single value proposition or stakeholder, because there are a range of ways to approach this type of analysis each with its own benefits and drawbacks. But getting the value equation right means that the methodology and the data should not be the starting point of the discussion. That's putting the cart before the horse.

The choice of methodology and the associated data and tool requirements should be the end product of a careful consideration of what value the hosting capacity analysis is intended to enable and who those use cases are intended to serve. Only by understanding the intended output of the methodology and the value proposition can one arrive at the right methodology, tools and data needed.

The development of a specific use case will be context specific and depend on factors such as utility structure, policy objectives, DER growth rates, regulatory environment, utility planning criteria and market structure. To help illustrate how these play out, it's instructive to look at a sample of use cases drawn from three of the more commonly discussed applications in the industry today:

1. **Enabling DER Development:** The most widespread use of hosting capacity is not as a tool for utilities, but rather as an externally-facing tool for DER developers. In this case, hosting capacity enables DER developers to identify locations in a utility's service territory where interconnection costs are likely to be lower and to direct their investments. To enable this value, utilities have published heat maps to provide information about the range of hosting capacity values across the system. The utilities in New York State recently published portals that fit this model.[2] In order to inform DER development, the analysis should include coverage across the full utility service territory, but since it is meant to be a guidance tool rather than attempting to quantify interconnection costs, the analysis can rely on careful approximations and more streamlined methods to ease the computation complexity of calculating hosting capacity values across the full system. This approach can also facilitate refreshing the analysis on a regular basis to give developers a more current view of where the system can accommodate additional DER.
2. **Enhancing DG Application Processes:** DG interconnection processes like Rule 21 in California or the Standardized Interconnection Requirements in New York often include a number of technical screens that help utilities identify which applications should be subject to more detailed study. Historically these technical screens have used a number of rules of thumb that don't adequately reflect the constraints on the system.

[2] Utility Specific Hosting Capacity: Overview of the Stage 2 Hosting Capacity Displays. jointutilitiesofny.org. http://jointutilitiesofny.org/utility-specific-pages/hosting-capacity/. 2017.

There could be an opportunity in these cases to leverage hosting capacity analysis to provide a better reflection of when an application is likely to cause a violation related to voltage, thermal, or protection criteria. Unlike the DER development use case, this is not intended to be a proactive guide for developers and so implementing hosting capacity analysis for this purpose alone would not necessarily require an online mapping interface. In the context of a technical screen, the Hosting Capacity analysis now provides utility insights as to the needed depth and analytical rigor necessary to process a new DG application. As such, the choice of methodology should reflect the locational and temporal impacts of the DG to the distribution system and expose the need for a more detailed study. This doesn't necessarily mean that the analysis needs to be a full iterative power flow analysis of every permutation of DER location and size, but it does mean that the importance of benchmarking against the results of a detailed study will be much more important for this application. As California begins to look at how Rule 21 can incorporate hosting capacity as part of Track 2 of the recent OIR, this will be an important consideration.[3] The incorporation of hosting capacity into the interconnection screening process requires a higher level of technical rigor to ensure the analysis provides technically sound information that can appropriately serve this type of use case.

3. **Advancing Distribution Planning Analytics:** The application of hosting capacity in the context of distribution system planning could enable utilities to identify when hosting capacity will become constrained on their system. This has been most directly explored in the contexts of California and Hawaii where distributed generation penetration has already begun to create specific system constraints. In the California context, utilities are starting to look at the impact of grid investments on hosting capacity, such as the DER integration considerations that Southern California Edison's enunciates in the context of their 4kV Programs.[4] In Hawaii, planners are using hosting capacity "to more appropriately predict and plan for the integration of DG-PV" by identifying circuits where they forecast hosting capacity limits being exceeded and evaluating the costs to mitigate any anticipated constraints.[5] A further application of this approach could include the identification of approaches that allow utilities to exceed nominal hosting capacity limits through approaches such as flexible interconnection.[6]

[3] ORDER INSTITUTING RULEMAKING TO CONSIDER STREAMLINING INTERCONNECTION OF DISTRIBUTED ENERGY RESOURCES AND IMPROVEMENTS TO RULE 21. cpuc.ca.gov. http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M191/K471/191471844.PDF. 2017.

[4] Southern California Edison. T&D- System Planning SCE-02. sce.com. http://www3.sce.com/sscc/law/dis/dbattach5e.nsf/0/308A07FD8137614A8825803B00728222/$FILE/WPSCE02V03RBkA-E.Takayesu.pdf. 2016

[5] Hawaiian Electric Companies. PSIPs Update Report. hawaiianelectric.com. https://www.hawaiianelectric.com/Documents/about_us/our_vision dkt_2014_0183_20161223_companies_PSIP_update_report_3_of_4.pdf. 2016.

[6] Avangrid. Flexible Interconnect Capacity Solution Demonstration Project Report. dps.ny.gov. http://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId=%7B6D9EFACC-17FF- 4695-9768-B89FA754EBA9%7D. 2016.

The application of hosting capacity in the planning context creates a touchpoint with long-term load and DER forecasting as well since the outputs from the forecast will be an input for this hosting capacity use case. Here, the temporal and geospatial granularity of long term forecasting will need to meet the requirements of being able to evaluate hosting capacity under future loads. This requires planners to develop a long-term granular forecast for load and DER so that the evolution of system load curves can inform projected hosting capacity. The result of this use case could impact the way utilities ultimately identify system needs if adequate cost recovery mechanisms are in place.

EXHIBIT 2. OVERVIEW OF USE CASES FOR HOSTING CAPACITY ANALYSIS

	Objective	Means	Challenges
Enabling DER Development	Accelerate DER deployment	Focus development capital in potentially lower cost areas	Regularly updated analysis of the full system, data visualization to facilitate external use
Enhancing DG Application Processes	Facilitate timely, more robust DG application process	Hosting capacity replaces less accurate rules of thumb in the interconnection technical screens	High granularity, required, model validation, benchmarking to detailed studies
Advancing Distribution Planning Analytics	Reduce future barriers to DER integration	Proactive identification of system upgrades to increase hosting capacity	Higher input data requirements

This is of course an illustrative set of use cases. The three use cases described above and summarized in Exhibit 2 can be combined to serve multiple needs and there are certainly other use cases for hosting capacity as well. This sample doesn't address "click and claim" interconnection use cases and additional internal utility use cases, but it does convey the importance of identifying in advance how various parties might derive value from hosting capacity. Doing so will ultimately shape the implementation of the analysis such that the outputs adequately serve the intended use case. We have also found in our work with clients across multiple states that this should be a shared understanding among utilities, regulators, and stakeholders. This allows for clear expectations, alignment on necessary investments and appropriate use of the analyses that are developed. The development of circuit models, the preparation of data, and the quality assurance necessary to develop these analyses requires substantial resources and investment and establishing the value proposition for this work up front will help create a clear path toward the best outcomes. Therefore, clearly defining use case is a key prerequisite to striking the right balance on hosting capacity to enable utilities, developers and policy makers to achieve their strategic objectives and to drive the most value for customers.

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About the Author

Samir Succar leads ICF's DER analytics group focused on long-term planning and energy market modeling. His work on distribution system planning has focused on the impacts of DERs on the distribution system and the quantification and valuation of the net locational benefits of those resources. His work also extends into the economics of increasing hosting capacity across a utility service territory to augment the amount DER that the system can accommodate. Samir's work also includes distribution system operations and systems that can facilitate optimization and coordinated dispatch of DERs to enable their provision of grid support services and market functions across multiple timescales. In addition, he has extensive experience in wholesale power markets modeling, power market supply-demand fundamentals, forward price curve assessments, and generation asset valuations. He has worked on a host of issues spanning ICF's Commercial Energy practice including Mexico's wholesale and retail electricity markets, power system modeling, energy storage, gas electric integration and wholesale market design. His transactional experience includes acquisition support for potential bidders, largely private equity and independent power producers (IPPs), and sellers of generation assets and portfolios.