N A R U C
National Association of Regulatory Utility Commissioners

State Commission Staff Surge Call: Hosting Capacity Analysis

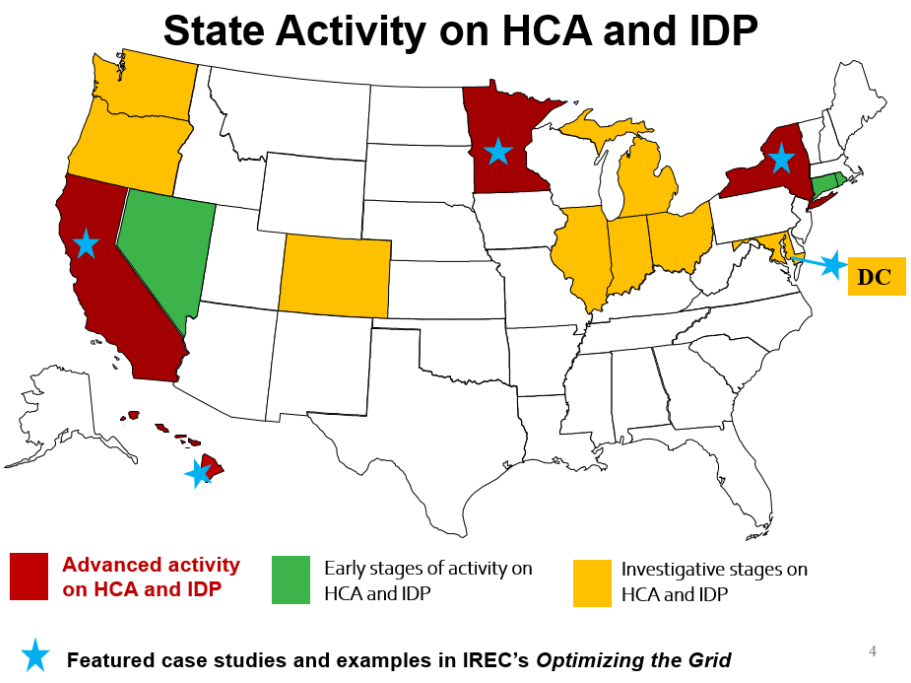
November 26, 2018

With many states responding to growing penetrations of distributed energy resources (DERs), state public utility commissions are using a number of strategies to improve the planning and operation of these resources to benefit the grid as a whole. During the NARUC Annual Meeting, the Staff Subcommittee on Energy Resources and the Environment hosted a session on hosting capacity analysis (HCA), an emerging tool to visualize the distribution grid. The Interstate Renewable Energy Council (IREC) defines HCA as "the amount of DERs that can be accommodated on the distribution system under existing grid conditions and operations without adversely impacting operational criteria or requiring significant infrastructure upgrades." Following the in-person presentation, the speakers reprised their discussions for a wider audience of commission staff:

- Sara Baldwin, Regulatory Program Director, IREC
- Steven Steffel, Pepco Holdings
- Terry Bruno, Electrical Engineer, Borrego Solar

IREC

Sara's presentation summarized IREC's "Optimizing the Grid" report on the regulatory aspects of HCA. IREC counted 16 states with early, intermediate, or advanced stages of activity on HCA and "integrated distribution planning" with DERs in mind. Use cases include guiding and informing DER interconnection, aiding distribution planning, and – with additional tools and analysis – establishing the locational value of DERs. Because front-of-meter and behind-the-meter DERs – including distributed solar, battery storage, electric vehicles, energy efficiency, and more – affect load and operational functions, HCA can be a useful tool to pinpoint locations on the grid that may experience excessively high levels of DER penetration, enabling regulators, utilities, and other stakeholders to take proactive measures to avoid local reliability issues. HCA can suggest where to avoid or incentivize further DER deployments.



HCA is based on four key inputs: DER location, load curve, feeder design, and DER technology. IREC showed two examples of previously completed HCA maps from Pacific Gas & Electric and Xcel Energy. Both maps were color-coded based on each feeder's capacity to host more DERs. PG&E also offers pop-up boxes showing detailed information for each feeder. Downloadable data files with even more data can help developers optimally design and site projects.

IREC suggested key steps for HCA:

1. Establish a stakeholder process
2. Select and define use cases
3. Identify criteria to guide HCA implementation
4. Develop HCA methodology
5. Validate results
6. Share and use HCA data
7. Track, learn, and evolve

Depending on which of the three use cases a commission selects, they will next choose a methodology. IREC presented four methodologies, each with pros and cons.

Method	**Pro**	**Con**
Streamlined	Fewer computations	Insufficient accuracy for interconnection
Distribution Resource Integration and Value Estimation (DRIVE)/Hybrid	Replicable	Accuracy uncertain
Iterative	Mimics a full power flow	Computational intensity
Stochastic	Fewer computations	Random/probabilistic

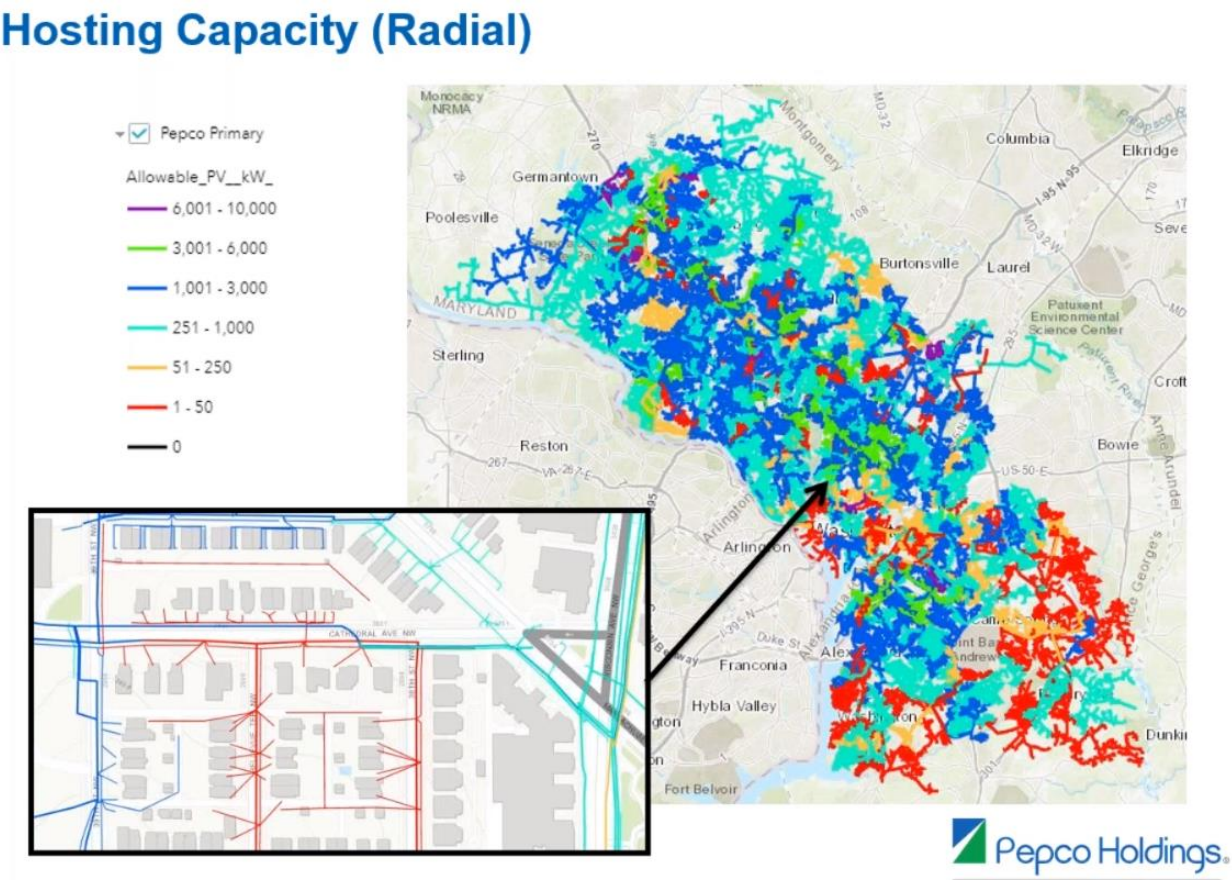
Elements of each methodology include the frequency of updates, ability to phase implementation, the extent of the grid being modeled, neutrality towards all types of DERs versus a detailed look at one particular technology, and transparency criteria. Commissions also need to set rules for data sharing, both for maps and data files.

Pepco Holdings

Steve Steffel presented on behalf of Pepco (PHI). PHI's net metered portfolio includes over 1 GW of installed solar for 61,000 customers, with close to 300 MW pending for 11,000 customers. Pepco considered all four HCA methods that IREC discussed and eventually selected a stochastic method because it currently lacks an automated system to make daily updates to hosting capacity, a key ingredient for the iterative method. The primary use case for PHI's HCA is supporting customer interconnection. Steve noted that HCA is still an approximation that generally does not account for substation transformers, transmission, secondary voltage rise, distribution automation, and other characteristics.

Pepco updates a public, cloud-based hosting capacity map at least once per month or whenever 500 kW of generation is added to a feeder or a major reconfiguration is completed. Pepco also posts separate maps of its secondary network and restricted circuits as well as a heat map showing installed and pending PV. Individual projects are not shown to maintain privacy, but aggregated active and pending system capacity by circuits provide ample information to developers. Comparing the heat map with the hosting capacity

map can reveal areas of low penetration and high hosting capacity – ideal locations for new installations. Similarly, the maps can show where high penetration intersects with low capacity – areas for developers to avoid.



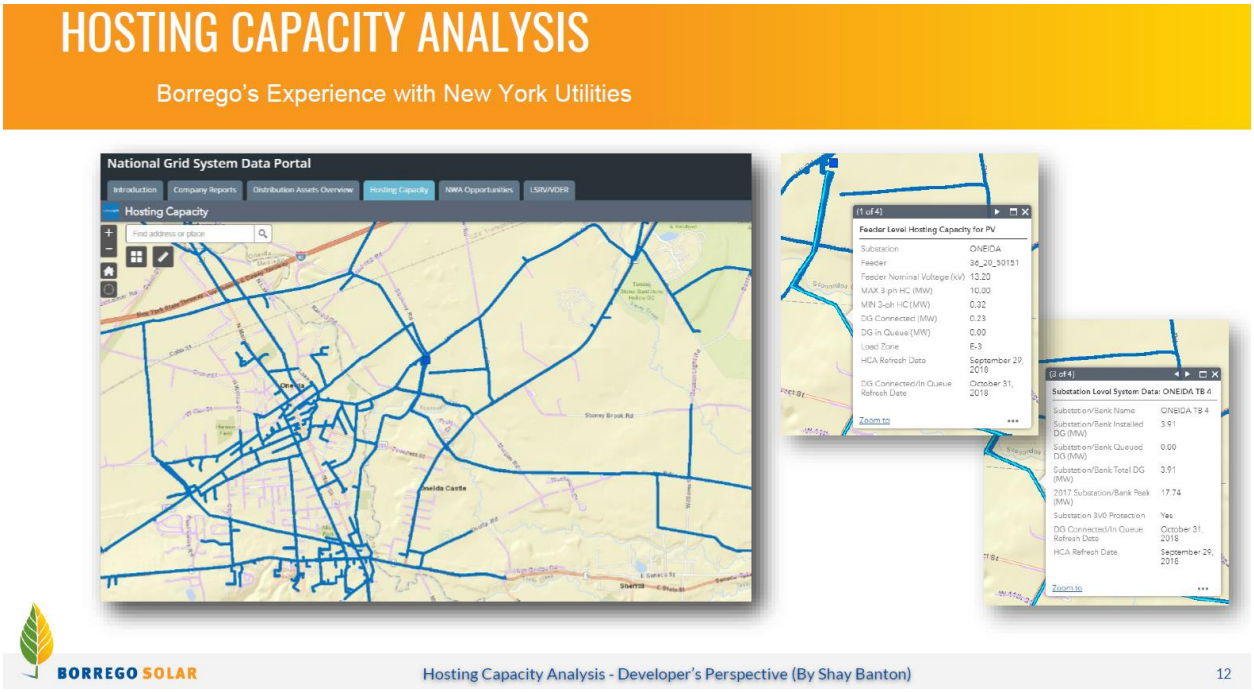
Steve found that hosting capacity has been a beneficial tool for Pepco, customers, and developers. For HCA to provide benefits, it has to be updated on a regular basis. In the future, Pepco also plans to pursue iterative hosting capacity with nightly updates, Advanced Distribution Management Systems to increase hosting capacity, and low-cost secure communications. Other tools could be useful in pinpointing the most cost-effective locations for electric vehicle fast-charging infrastructure, for example. Steve also presented ways to increase hosting capacity based on Department of Energy-funded studies. Smart inverters with dynamic controls were among the best ways to increase hosting capacity in a cost-effective manner.

Borrego Solar

Borrego Solar began in 1980 as a residential rooftop installer and has since pivoted to large-scale commercial utility systems. As an established developer, Borrego has extensive experience in working through the interconnection process. Data available from utilities at the pre-application, initial review, and impact study stages of the process varies by state. Interconnection costs are primarily driven by substation and reconductoring upgrades.

Borrego views HCA as a beneficial tool to streamline the interconnection process, encourage development in advantageous areas, and remove suboptimal projects from the interconnection queue. However, as other speakers pointed out, HCA takes planning and refinement.

New York's process offers an example of how a state can develop a process to implement HCA. First, utilities published red-zone maps highlighting locations with high interconnection costs and enhanced indicator maps with additional data. Next, utilities developed heat maps of hosting capacity per feeder with large, centralized solar PV scenarios featuring pop-ups with more information. In the coming months, utilities will expand the pop-ups to include more feeder-specific data. And in the long term, the state will increase the spatial granularity of the data, model existing DERs, produce substation-level hosting capacity maps, and perform fully integrated value assessments using granular, current, and high-quality data.



New York solicited stakeholder input with conferences, webinars, and bi-monthly Interconnection Technical Working Group meetings. Borrego hopes to have more input in future HCA planning, particularly into HCA study methodologies and the frequency of HCA updates. Because developers are a key audience for HCA, their input at all stages of the process is critical to its success. Borrego also wants the HCA process to be more flexible to accommodate emerging distributed generation as well as improved transparency of utilities' distribution systems and utility upgrade cost standardization efforts. In the future, Borrego and other developers want HCA maps to filter to isolate low-upgrade areas for different varieties of DERs.

The benefits of HCA in New York are already clear, according to Borrego. Interconnection timelines have been reduced by 30 business days. Utilities are seeing reduced resources to produce pre-application reports now that developers are opting to skip that step thanks to the improved availability of

interconnection data, allowing utilities to shift resources towards automating parts of the application process. Instances of failed applications and restudies have fallen.

Q&A

How important is advanced metering infrastructure to the success of HCA?

Pepco uses hourly AMI data in advanced power flow modeling, but it is also important to have DERs integrated into the model. For states that have not yet deployed AMI, interconnection applications, load profiles, weather and consumption data, and customer surveys can be good starting points.

Was there a regulatory driver for Pepco to conduct HCA? How are costs recovered?

Pepco is regulated by four commissions, none of which mandated the utility to begin HCA. A DOE grant and advanced power flow modeling covered the expense.

In the spectrum of what HCA can do, how can commission staff in different states best consider the trade-offs in cost, frequency, detail, and accuracy of various HCA methodologies?

Every state's policy context should set the ground rules for the short-term and long-term goals of HCA, in IREC's view. Stakeholder conversations can help states establish what HCA should do. In Pepco's view, heat maps can be a good first step to begin the conversation around HCA.

Does the use of more granular data create security concerns?

As information sharing and cloud applications increase, commissions should be aware of cybersecurity issues as they consider HCA. Commissions need to balance the transparency goals of HCA with consumer privacy and system security concerns. IREC recommends that commissions establish a clear definition of critical electric infrastructure information – avoiding overly broad terms that will lead to substantial redactions of useful data – perhaps with a reasonable screening process for HCA users.

What are the quantifiable benefits of HCA?

Pepco does not use the HCA to analyze interconnection applications, but HCA is informative to choosing circuit-level upgrades to increase hosting capacity. Borrego has seen cost and time savings from developers choosing to forgo the pre-application process.

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