Distribution System Planning Part 2:
- Hosting capacity analysis
- Non-wires alternatives
- Voluntary planning and surcharges

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Hosting Capacity Analysis - 1

- Amount of DERs that can be interconnected without adversely impacting power quality or reliability under existing control and protection systems and without infrastructure upgrades
- Some states require regulated utilities to do it
  - CA, HI, MN, NY
- Some utilities do it on their own motion
  - e.g., Pepco
- Power system criteria
  - Thermal
  - Power quality/voltage
  - Protection
  - Reliability/safety

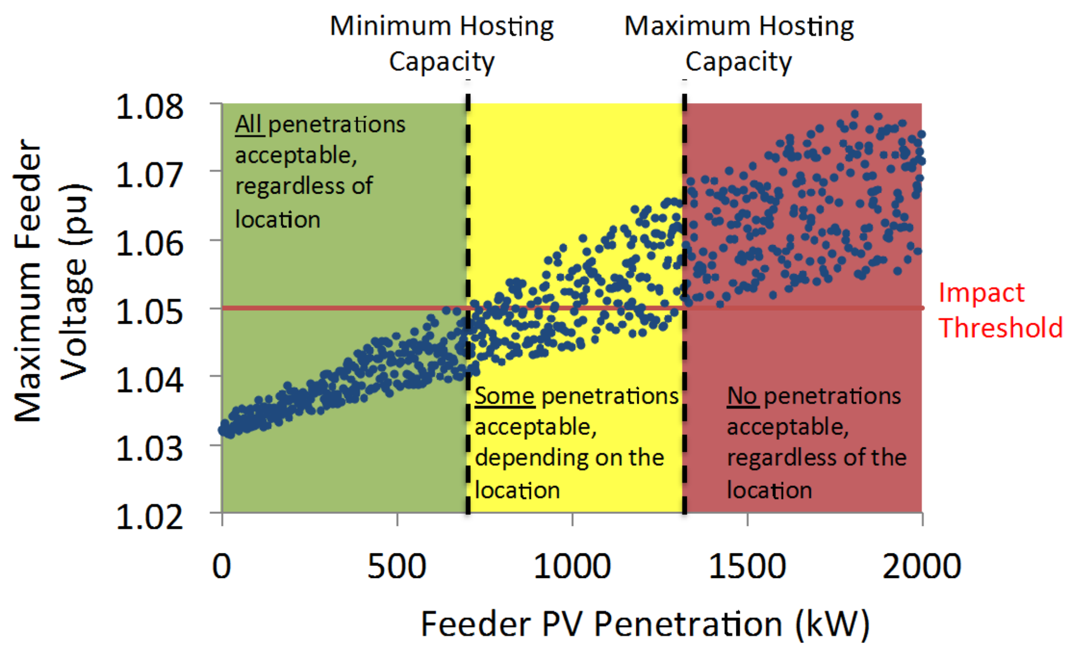


Figure adapted by Berkeley Lab from EPRI (2015), *Distribution Feeder Hosting Capacity: What Matters When Planning for DER?*

Hosting Capacity Analysis - 2

Methodologies

Detailed Analysis	**Iterative** power flow simulations conducted at each node until violations occur — e.g., SCE, SDG&E, PG&E and Pepco. **Stochastic** analysis (piloted by EPRI) uses many simulations (such as different sizes in different locations) to give uncertainty range.
Streamlined	Simplified algorithms for each power system limitation to estimate when violations occur — e.g., PG&E and SCE initially used this method. Xcel and NY utilities use EPRI's DRIVE tool, a combination of streamlined and stochastic.
Shorthand Equations	Very simple calculation method, developed by EPRI/NREL

Source: Slobodan Matic, GE Consulting

Hosting Capacity Analysis - 3

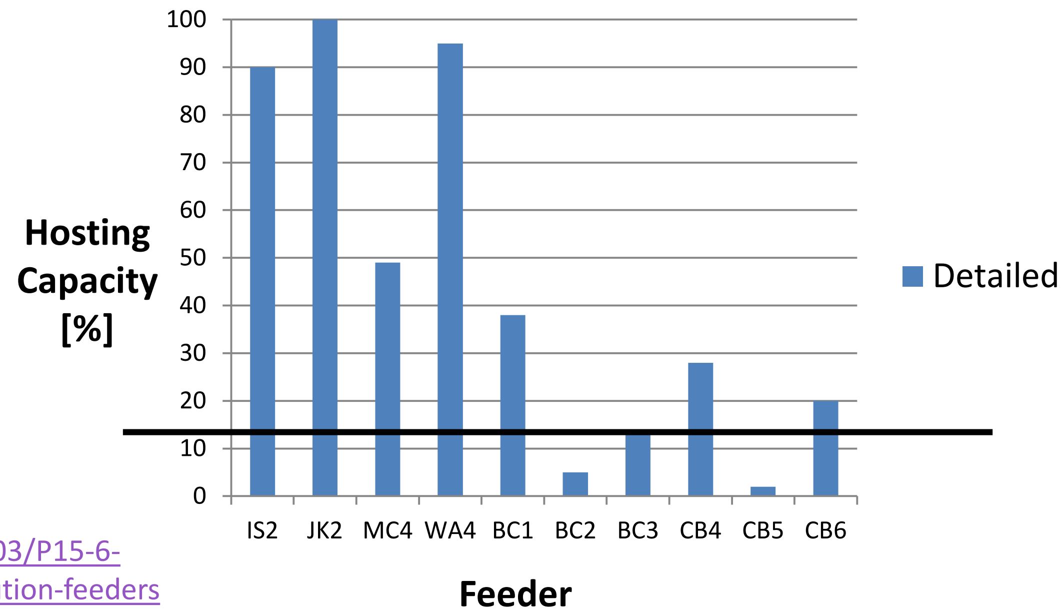
Three use cases

Use Case	Objective	Capability
Development Guide	**Support market-driven DER deployment**	**Identify areas with potentially lower interconnection costs**
Interconnection Technical Screens	**Improve the interconnection screening process**	**Augment or replace rules of thumb; determine need for detailed study**
Distribution Planning Tool	**Enable greater DER integration**	**Identify potential future constraints and proactive upgrades**

Adapted from ICF International, forthcoming report for U.S. DOE

Example: Interconnection screening

"15% rule" allows aggregate DER penetration below 15% of feeder peak load



Graph: DSTAR, http://www.dstar.org/research/project/103/P15-6-impact-and-practical-limits-of-pv-penetration-on-distribution-feeders

Hosting Capacity Analysis - 4

- Example: Minnesota
  - State law requires Xcel Energy to conduct a distribution study to identify interconnection points for small-scale distributed generation (DG) and system upgrades to support DG development
  - No formal Commission action is required
  - Xcel filed 1st hosting capacity analysis on 12/1/16 (Docket 15-962)
    - Staff issued briefing papers and parties commented
    - Commission decision required hosting capacity analyses Nov. 1 each year and provided guidance for 2017 analysis:
      - Reliable estimates and maps of available hosting capacity at feeder level
      - Details to inform distribution planning and upgrades for efficient DG integration
      - Detailed information on data, modeling assumptions and methodologies
  - Xcel Energy filed 2nd analysis on 11/1/17 (Docket 17-777)
  - PUC staff filed briefing papers and proposed distribution planning requirements for all regulated utilities at 4/19/18 public meeting (Docket 15-556) — includes hosting capacity analysis

Non-Wires Alternatives – 1★

- Investments in energy efficiency, demand response, distributed generation and storage that provide specific services at specific locations in order to defer, mitigate or eliminate the need for traditional distribution infrastructure investments — for example:
  - New York - Utilities jointly provided suitability criteria for NWAs and described how criteria will be applied to projects in their capital plans

Project Type Suitability	Project types include Load Relief and Reliability*. Other categories currently have minimal suitability and will be reviewed as suitability changes due to State policy or technological changes.	
Timeline Suitability	**Large Project**	36 to 60 months
	Small Project	18 to 24 months
Cost Suitability	**Large Project**	$\geq$ $1M
	Small Project	$\geq$ $300k

*Reliability projects entail projects for remote single source regions or customer-requested enhanced reliability projects. Source: Central Hudson NWA Opportunity

★Natalie Mims Frick contributed research for these NWA slides.

Non-Wires Alternatives – 2

- The NY Joint Utilities' supplemental filing describes how utilities use their procurement processes to award contracts for NWAs. Information on the Joint Utilities NWA process is here and on the REV Connect website.

Utility	Project Name	Project Type	Project Size	Project status and procurement and development timeline
Central Hudson	Philips Road/ Substation	Load relief	Large (5 MW)	RFP issued: 11/2014 Timeline: 42 mo.
Central Hudson	Coldenham/ Distribution Feeder Upgrade	Load relief	Small (1 MW)	RFP issued: 3/2017 Timeline: 34 mos.
NYSEG	Java 2nd Transformer and 12 kV Conversion	Load relief and reliability	Not provided	RFP issued: 2016 Timeline: 3/2019
Con Ed	West 42nd St Load Transfer	Load relief	42 MW	RFP issued: 12/2017 Timeline: 12 MW needed by May 2021

Non-Wires Alternatives – 3

- **CA** PUC staff proposed a Distribution Investment Deferral Framework (DIDF) on 6/30/17
  - Part of a rulemaking to establish policies, procedures and rules to guide IOUs in developing Distribution Resource Plan Proposals

- CPUC order 2/15/18
  - "The central objective of the DIDF is to identify and capture opportunities for DERs to cost-effectively defer or avoid traditional IOU investments that are planned to mitigate forecasted deficiencies of the distribution system."
  - IOUs file annually detailed Grid Needs Assessment and Distribution Deferral Opportunity Report. General rate case applications must match these filings.
  - Distribution Planning Advisory Group – Stakeholder feedback on reports
  - Annually by Dec. 1, each IOU recommends distribution deferral projects for solicitations via the Competitive Solicitation Framework Request for Offers.

Non-Wires Alternatives – 4

- **RI**
  - PUC created Least Cost Procurement Standards in July 2017 (Docket 4684) with guidelines for incorporating NWAs into utility System Reliability Procurement (SRP) plans. NWA implementation costs, as well as other types of expenditures, are recovered in SRP.
  - In August 2017, National Grid filed its Efficiency and System Reliability Procurement Plan. The SRP plan highlighted the use of NWAs for:
    - Highly utilized distribution systems
    - Areas where construction is physically constrained
    - Areas where the utility anticipates demand growth
  - Investigation Into the Changing Electric Distribution System (Docket No 4600) produced a Guidance Document in October 2017 on how the PUC will consider distribution system investments in National Grid regulatory proceedings.
  - Power Sector Transformation Initiative Phase I report, November 2017

Voluntary Planning and Surcharges

- Legislation in some states encourages utilities to accelerate investments in grid modernization or replacement of aging facilities to improve safety, resilience and reliability — for example:
  - **IL** - Energy Infrastructure Modernization Act allows utilities to file investment plans for distribution upgrades (e.g., smart meters, grid hardening)
    - Utilities file annual Grid Modernization Action Plans with formula rates for approval by Commerce Commission (e.g., ICC order on Ameren plan)
  - **IN** - Transmission, Distribution, and Storage System Improvement Charge to encourage T&D investments for safety, reliability, modernization
    - 7-year plans, for approval by Indiana Utility Regulatory Commission
    - For capital projects (*not* for vegetation management)
    - Charge limited to 80% of "approved capital expenditures and TDSIC costs"; remaining 20% addressed in general rate case
  - **MD** – BGE and Pepco used surcharge riders to recover costs for accelerated distribution system upgrades designed to increase grid resilience in response to weather events that caused widespread outages.
  - **PA** – Utilities can propose a Distribution System Improvement Charge to recover reasonable and prudent costs to repair, improve or replace certain eligible distribution property by filing Long Term Infrastructure Improvement Plans (e.g., see FirstEnergy LTIIP)