Minnesota Hosting Capacity Analysis

MIPSYCON – November 8, 2017

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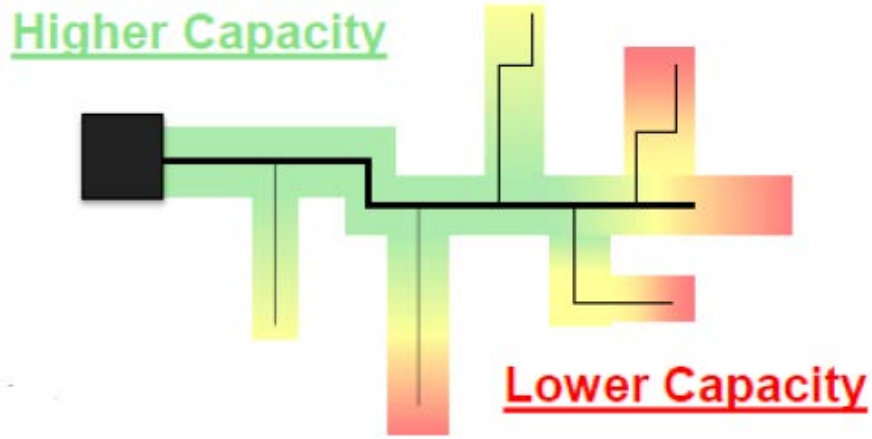
Outline

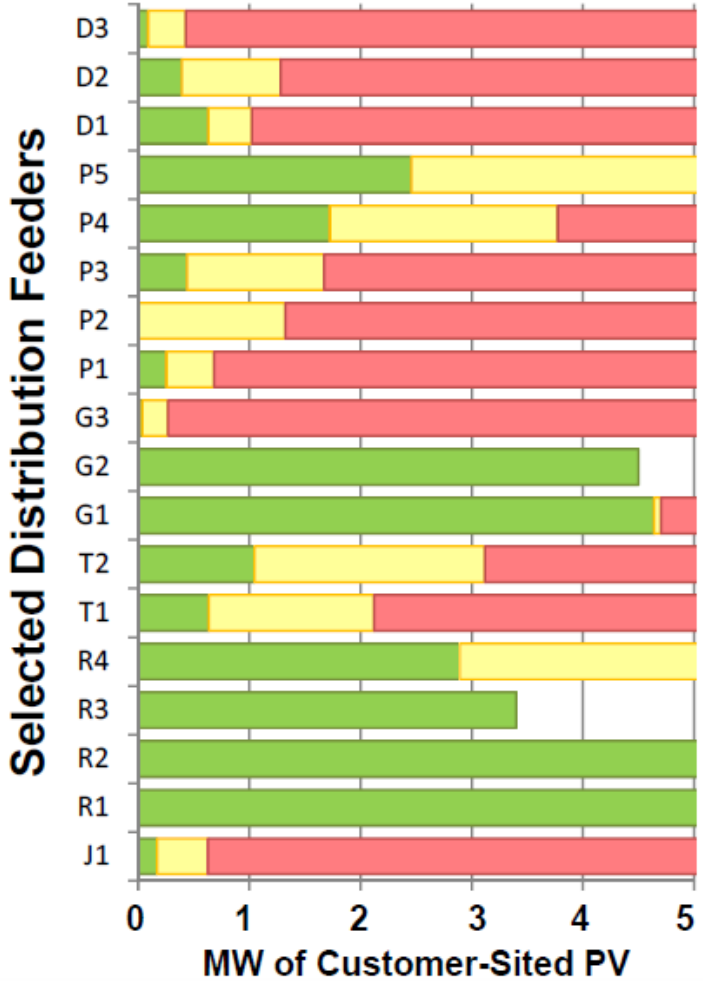
- What is Hosting Capacity?
- Background
- DRIVE
- Results
- Visualization
- Accuracy
- Timeline
- Next Steps

What is Hosting Capacity?

The Electric Power Research Institute (EPRI) has defined hosting capacity as the amount of DER that can be accommodated on the existing system without adversely impacting power quality or reliability.

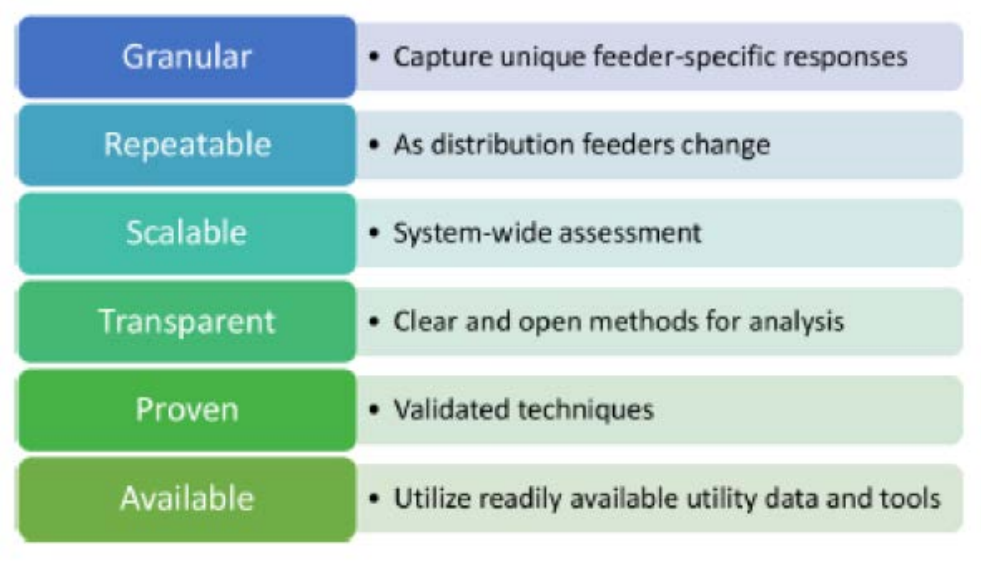


Example:
PV Hosting Comparison by Feeder



What is Hosting Capacity?

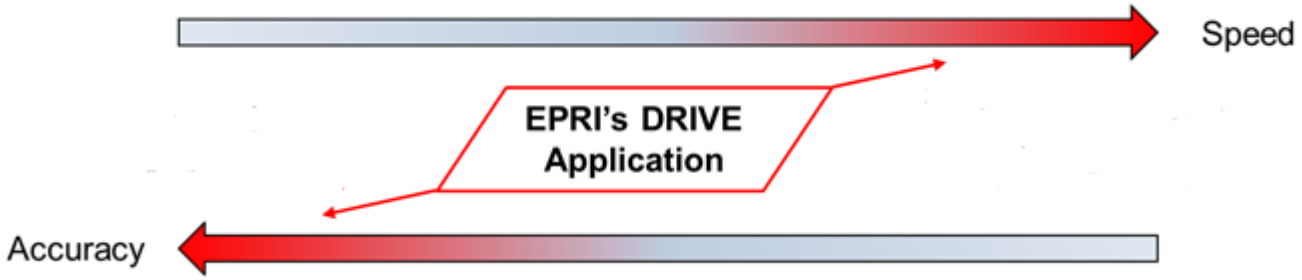
Fundamental Requirements



What is Hosting Capacity?

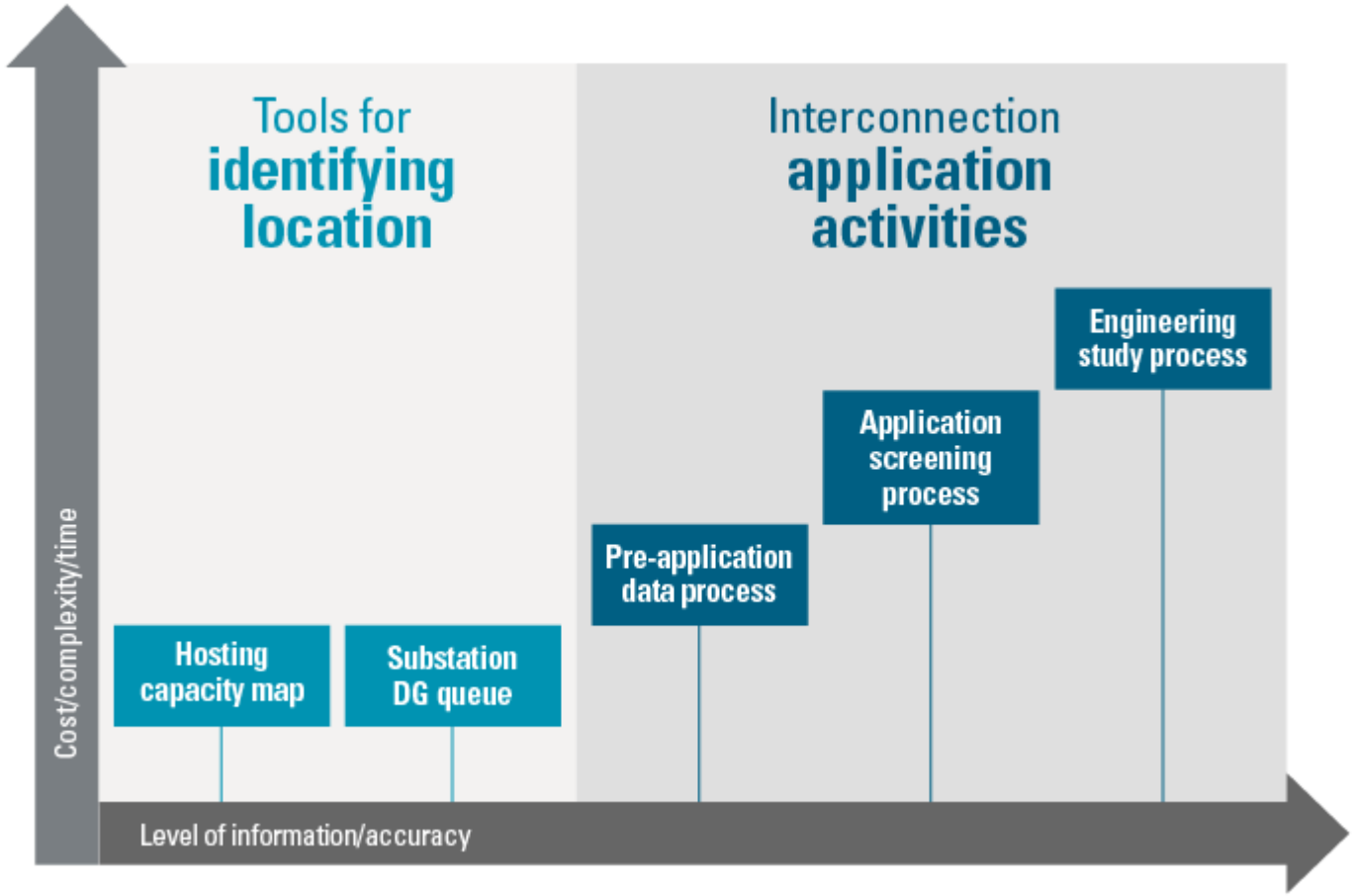
Differing Methodologies

- Iterative vs. Streamlined
  - Iterative
    - More data intensive
    - More accurate for interconnection studies
  - Streamlined
    - Faster processing



What is Hosting Capacity?

Usage



Background

Minn. Stat. § 216B.2425, subd. 8. requires that a utility operating under an approved multiyear rate plan:

- *shall conduct a distribution study to identify interconnection points on its distribution system for small-scale distributed generation resources and shall identify necessary distribution upgrades to support the continued development of distributed generation resources, and shall include the study in its report required under subdivision 2.*

Background

12/1/15 – Filed first Grid Modernization Report

6/28/16 – MPUC Order to complete Hosting Capacity Analysis

12/1/16 – Filed first Hosting Capacity Report

3/20/17 – Filed Supplemental Comments due to MPUC Information Request

5/05/17 – Filed Reply Comments addressing all stakeholders concerns

6/15/17 – MPUC Hearing

8/01/17 – MPUC Order for next analysis

11/1/17 – Filed second Hosting Capacity Report

Background

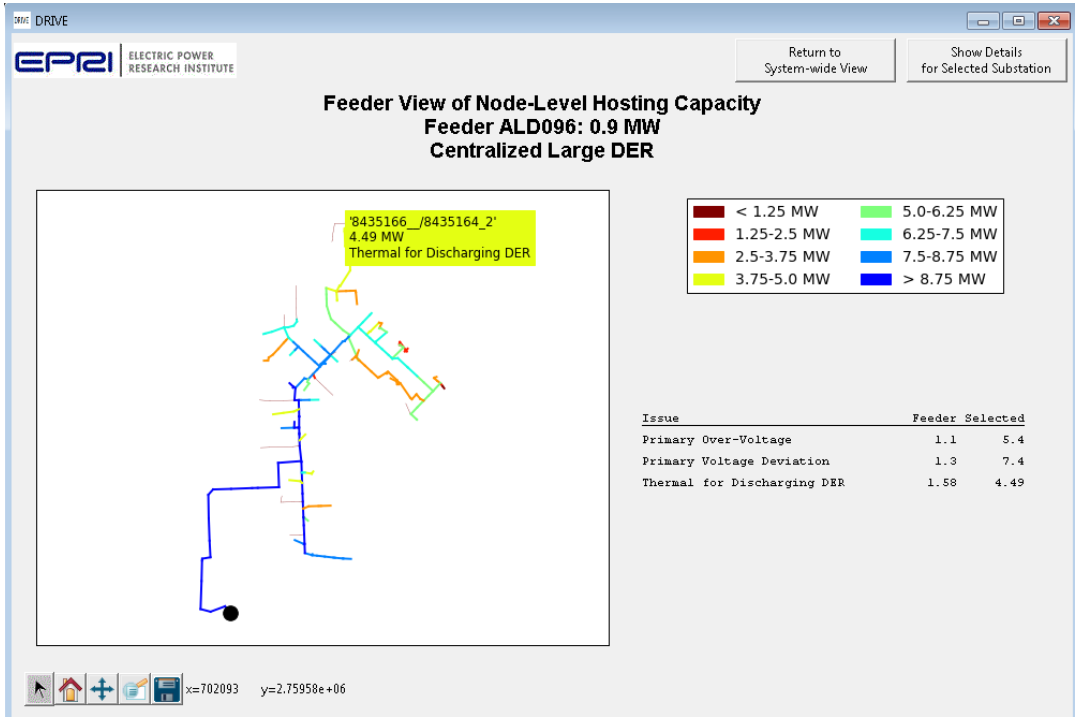
August 1, 2017 Commission Order

- Detailed enough to provide developers with a starting point
- Detailed enough to inform future Distribution System Planning Efforts
- Downloadable results
- Provide methodology, assumptions, details, etc. in Report
- Report on accuracy of the analysis
- File Hosting Capacity report on annual basis (November 1st)
- Color coded map

DRIVE

Distribution Resource Integration and Value Estimation

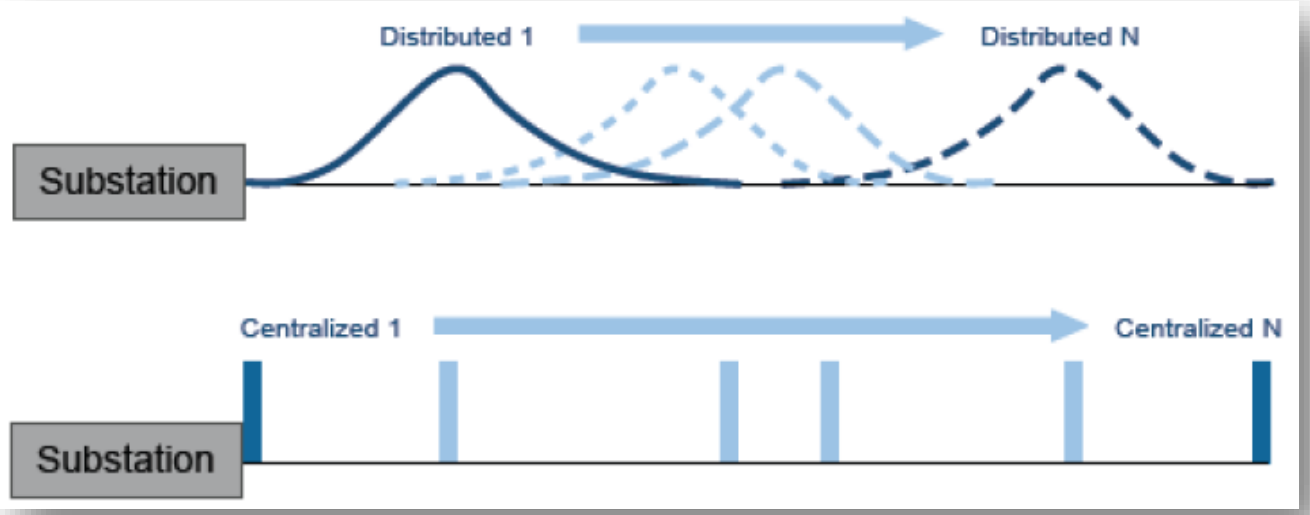
- Developed by EPRI
- Utilizes Synergi models
- Produces tabular and visual results
- User Group
- Widely Utilized
  - NY Joint Utilities
  - Southern Co
  - Salt River Project
  - TVA



DRIVE

Methodologies

- Analysis: Adds DER to the feeder
  - Small Distributed
  - Large Centralized
  - Large Distributed



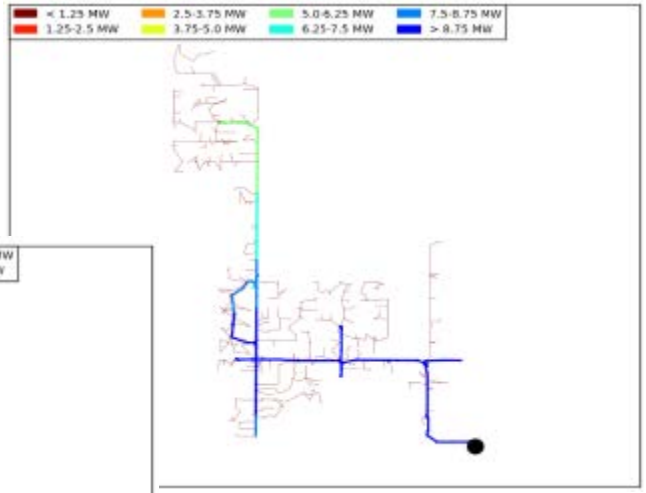
DRIVE

- 2017 Key Analysis Assumptions
  - 0.98 leading power factor of new DG installations
  - Daytime Minimum loading at 20% of Peak
  - Substation and Transmission Capacity exists
  - “Year ahead” capacity projects added
  - Solar Gardens
    - Anticipated additions through signed interconnection agreements

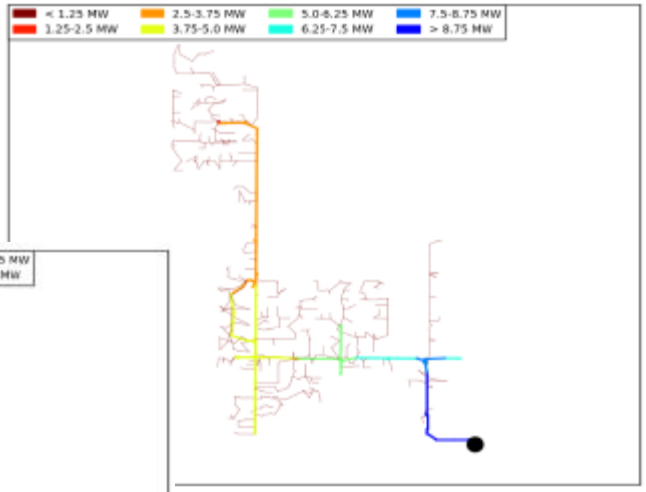
DRIVE

Power Factor Impact

0.95 => 8.75 MVA



0.98 => 5.0 MVA



Unity => 2.5 MVA

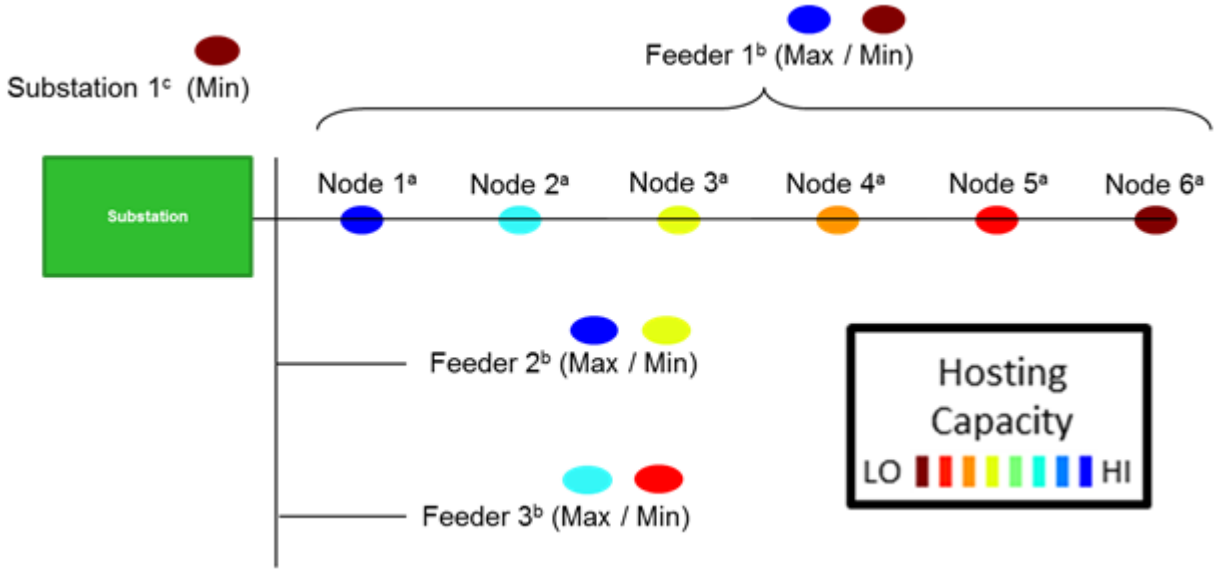
DRIVE

Thresholds

Criteria	Description	Threshold	Basis
Primary Over-Voltage	High voltage exceeds nominal voltage by threshold	105%	ANSI C84.1 Range A – Maintain quality of service to customers
Primary Voltage Deviation	Change in Voltage from no DER to full DER	3%	MN Tariff Section 10, Sheet No. 146 – Maintain power quality for customers
Regulator Voltage Deviation	Change in bandwidth from no DER output to full DER output at a regulated node	50%	Prevent reliability and power quality issues by avoiding excessive regulator operations
Thermal for Discharging DER	Element rating	100%	Continue reliable customer service by staying within the normal ratings of existing elements
Additional Element Fault Current	Deviation in feeder fault currents	10%	Based on worst case scenarios from internal studies – maintain customer reliability
Breaker Relay Reduction of Reach	Deviation in breaker fault current	10%	Based on worst case scenarios from internal studies – maintain customer reliability

DRIVE

- Minimum Hosting Capacity – The Maximum Amount of DER that can be accommodated anywhere on the feeder
- Maximum Hosting Capacity – The Maximum Amount of DER that can be accommodated at one point on the feeder



Results

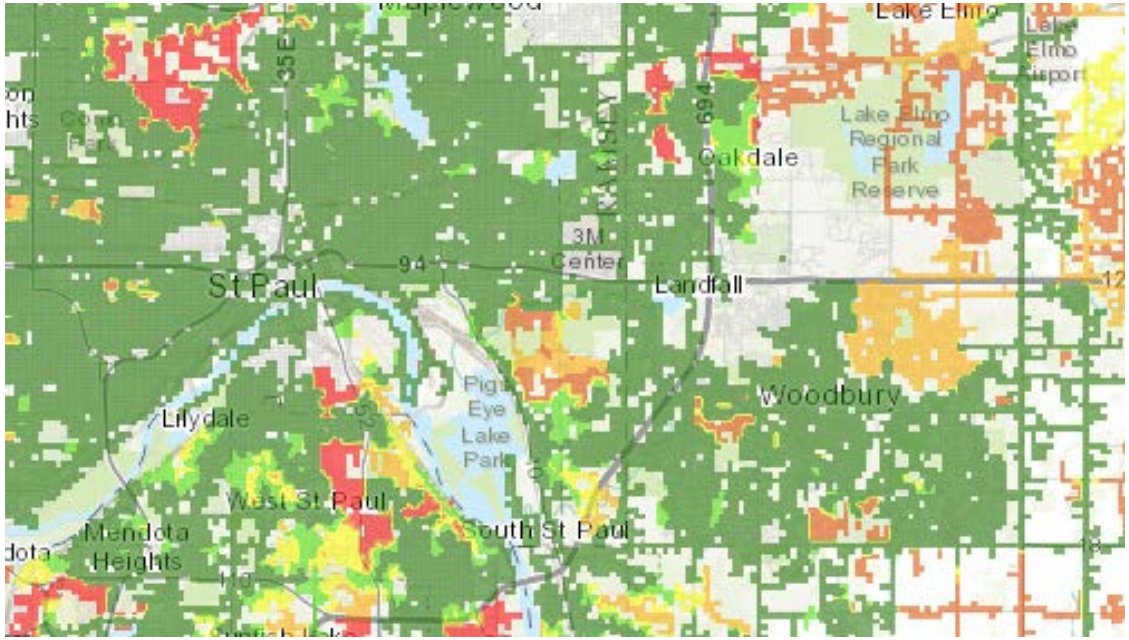
- 2017 – 1047 feeders
  - Average min hosting capacity = 1.5 MW
    - Approximately 75% limited by Over-Voltage and 25% limited by Thermal Overloads
    - Small percentage limited by reduction of reach, additional fault current, and voltage deviation
    - 177 feeders with zero hosting capacity
    - 619 feeders with 1 MW or greater of hosting capacity
  - Average max hosting capacity = 6.1 MW
  - Feeders with more hosting capacity had:
    - Higher concentration of load
    - Shorter feeder lengths
    - Higher voltages

Results


20
15
10
5
0
0
200
400
600
800
1000
Min Hosting Capacities
AVG Min
Max Hosting Capacities
AVG Max

Visualization

- Mapping Results
  - Security vs. Usability



https://www.xcelenergy.com/working_with_us/how_to_interconnect/hosting_capacity_map_disclaimer

Accuracy

- Hosting Capacity is difficult to compare to Interconnection Studies
  - Different models and modeling techniques
  - Changing Criteria
  - Differing Assumptions
  - Interconnection studies didn't originally contain baseline hosting capacity
  - Many of the hosting capacity results already contained projects that had been studied

  Processes are evolving and will better align and stabilize with each iteration

Accuracy

- Compared 15 Locations

	Number of feeders/ applications	Number of favorable[9] results	Number of unfavorable[10] results	Value in which unfavorable Hosting Capacity results were below approved value (kW)
2016 Screens	6	5	1	700
2017 Screens	5	5	0	-
2017 Studies	4	3	1	300

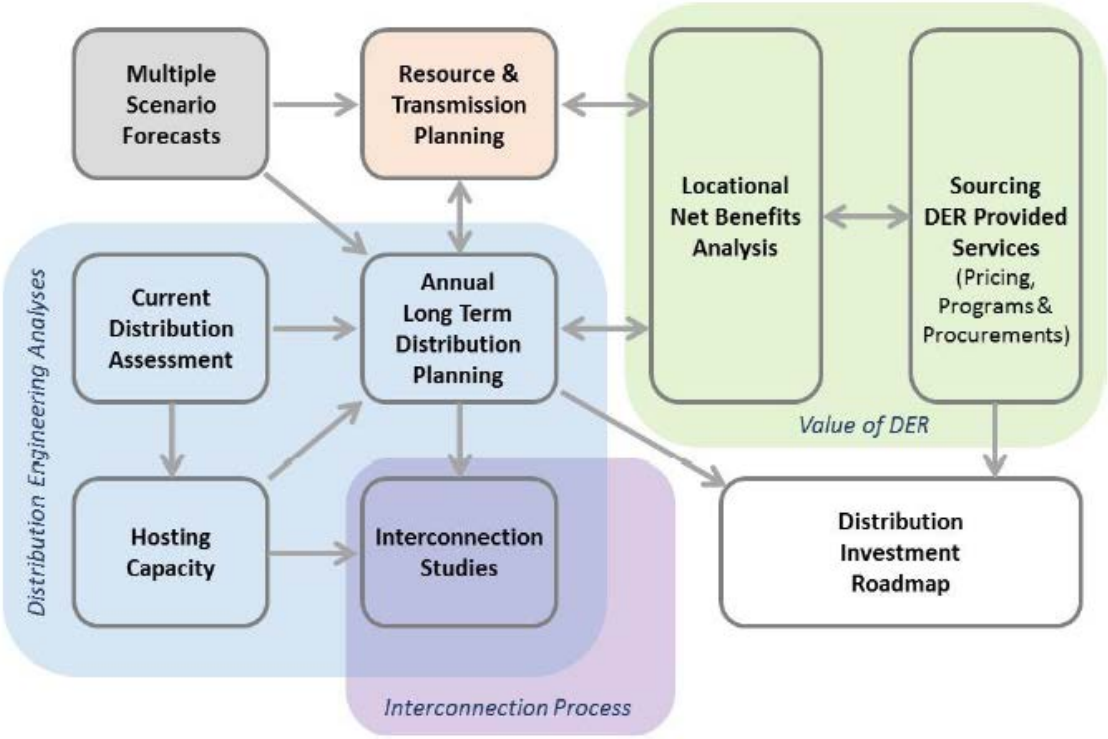
- Mostly favorable results
- Hosting Capacity was conservative where unfavorable

Timeline

- 2017 Process
  - Pre Work (January - May)
    - GIS improvements and map testing
    - Upgrade and Test software – DRIVE and Synergi
    - Threshold setting and buy-in
    - Synergi Training/Documentation
    - Source Impedance creation
  - Build Models (June - August) => Integrate with planning cycle in future
    - Model existing generation
    - Utilize forecasted 2018 peak data and interconnection queue process
  - Run DRIVE to perform the analysis (August - September)
  - Format results and map (September - October)
  - Write Report (October)

Next Steps

- Distribution Planning
  - Part of Process
  - Utilize Results
- Continued Improvements
  - Tool
  - Modeling
  - Process improvements
- Mapping
  - Detail
  - Features
- Industry Collaboration
- Methods for Increasing Hosting Capacity



* Source: ICF – Integrated Distribution Planning Report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