CIGRE US National Committee

2017 Grid of the Future Symposium

ELECTRIC POWER RESEARCH INSTITUTE

Hosting Capacity for Distributed Energy Resources on Distribution Feeders

A Case Study

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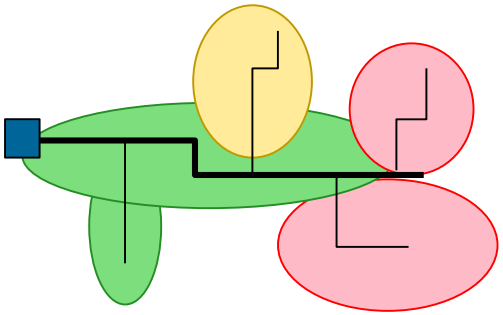
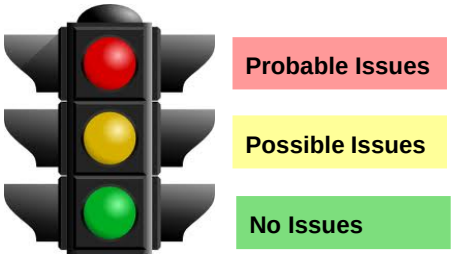
Hosting Capacity

- What is Hosting Capacity?
  Amount of DER that can be accommodated on a given feeder without impacting system operation under existing control and infrastructure configurations



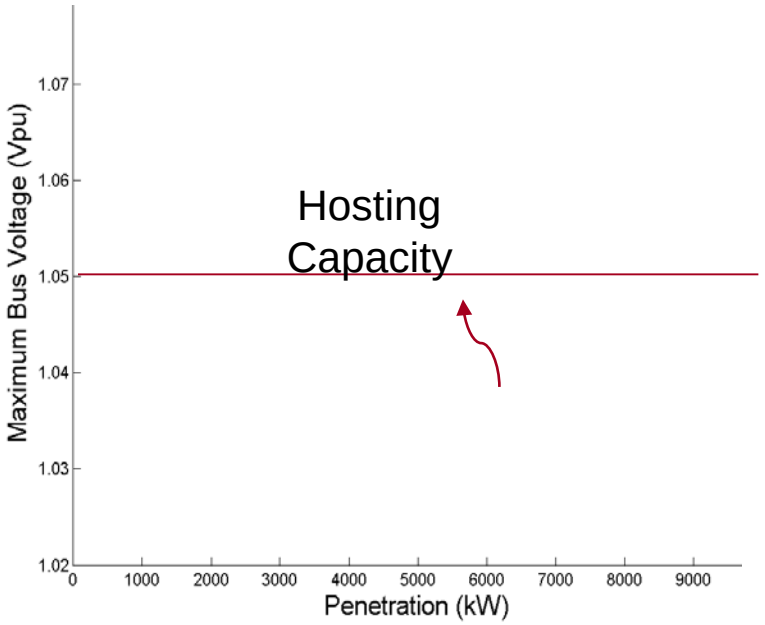
- Feeder Impact Issues of Concern
  - Voltage
  - Loading
  - Protection
  - Control



- What could impact Hosting Capacity?
  - Feeder characteristics
  - DER size and Locations
  - DER type

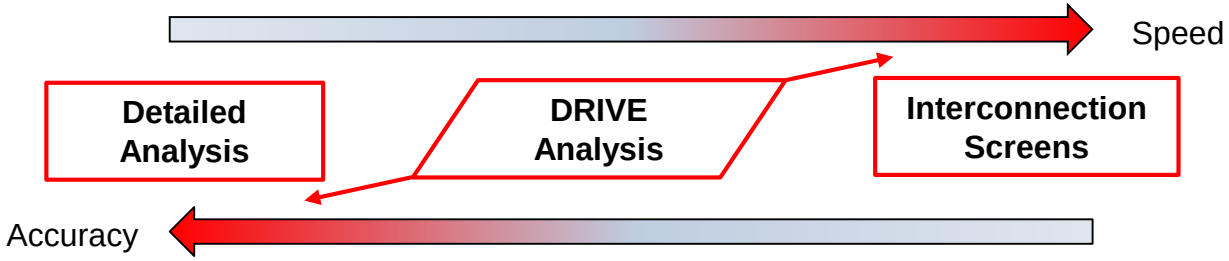
Detailed Study to Determine Hosting Capacity

- Step 1: Create thousands potential DER deployment scenarios
- Step 2: Run DER from zero to full output to identify the feeder responses
- Step3: Determine hosting capacities based on feeder responses



Feeder Assessment Methods

- ***Detailed Analysis*** – time consuming
- ***Interconnection Screens*** – such as in FERC SGIP fast-track screening or in CA rule 21 screening procedures.
- ***Alternative Method*** – **D**istribution **R**esource **I**ntegration and **V**alue **E**stimation (DRIVE) developed by EPRI using learnings from detailed analysis to develop effective and time-efficient methods for analyzing larger numbers of feeders



DRIVE Method

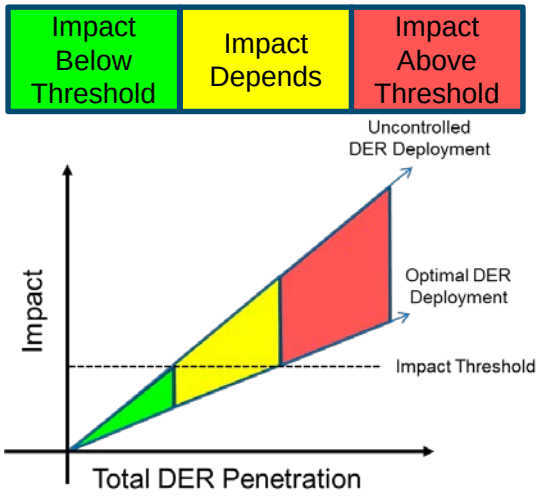
- Captures what matters most
  - DER technology and impacts
  - DER size and location
  - Feeder design and operation

Voltage

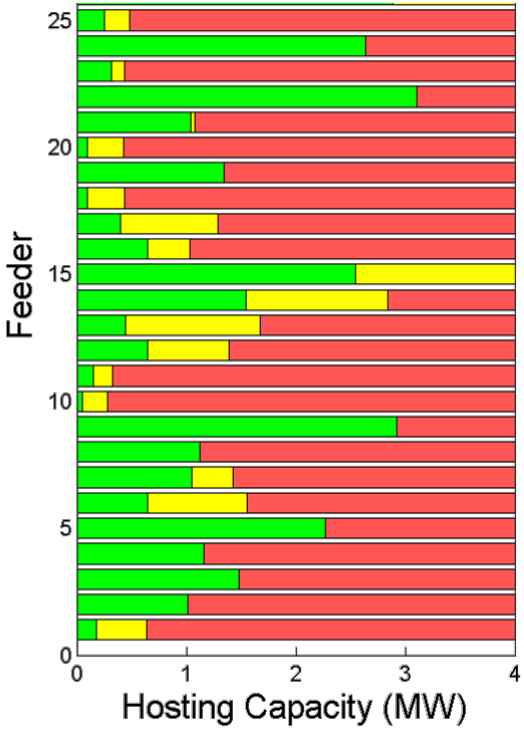
Protection coordination

Thermal capacity

DER Technology and Impacts



DER Size and Location

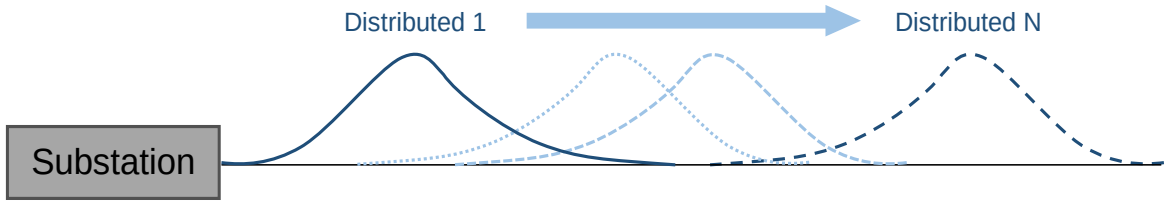


Feeder Design and Operation

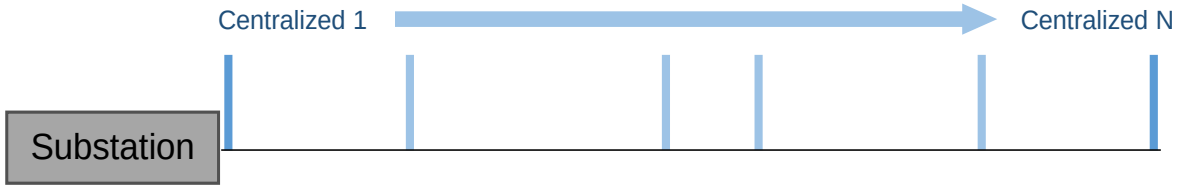
DER distributions

DER Options Considered

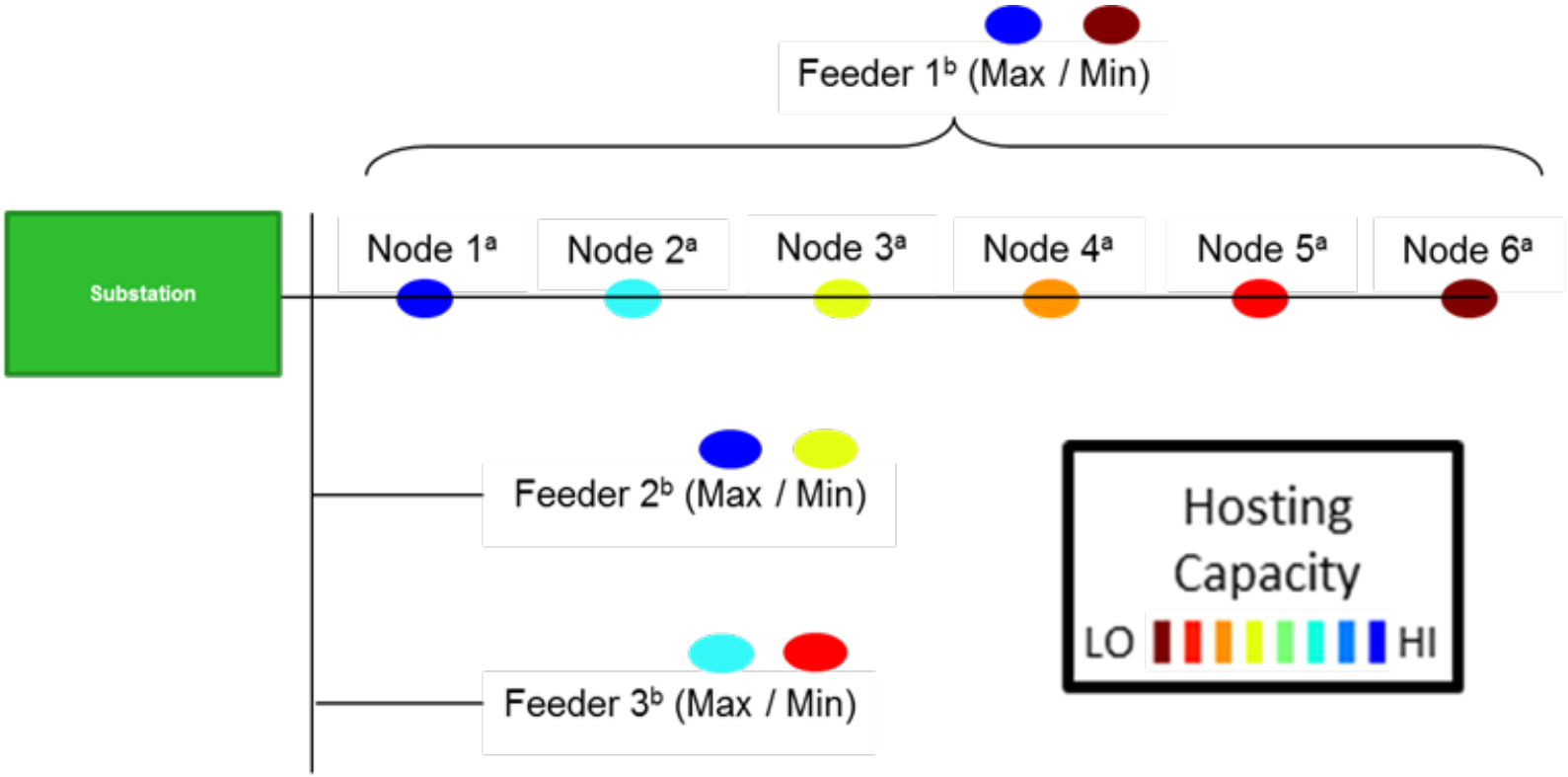
- Distributed



- Centralized



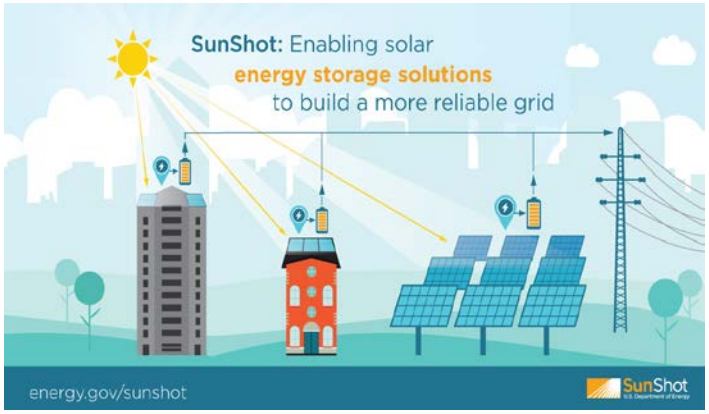
Hosting Capacity



[a] Node Hosting Capacity is dependent on DER at other nodes. That shown above is based on DER only at the specified Node.

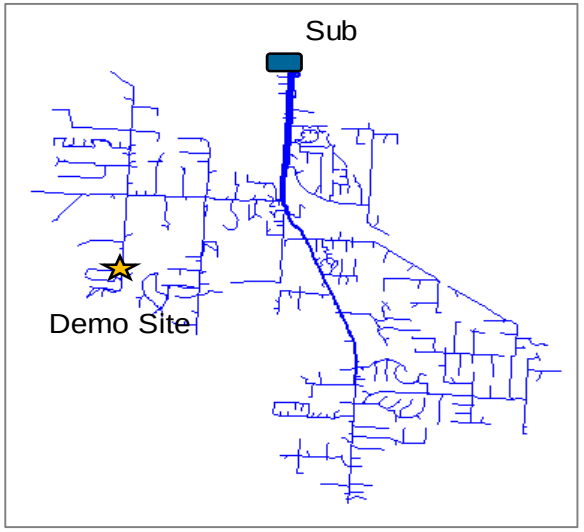
[b] Feeder Hosting Capacity is the Maximum/Minimum range of Node Hosting Capacity on the feeder.

Application of DRIVE Analysis on DOE SHINES Demo Sites



SUSTAINABLE AND HOLISTIC INTEGRATION OF ENERGY STORAGE AND SOLAR PV (SHINES)

Goal: develop integrated control strategies for solar PV, energy storage, and load management to maximize the integration benefits

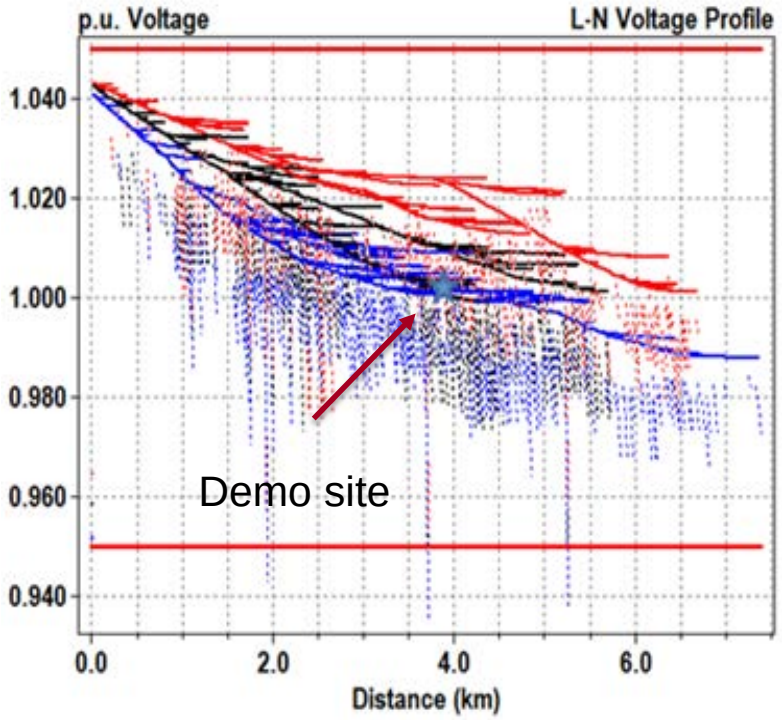


Feeder circuit

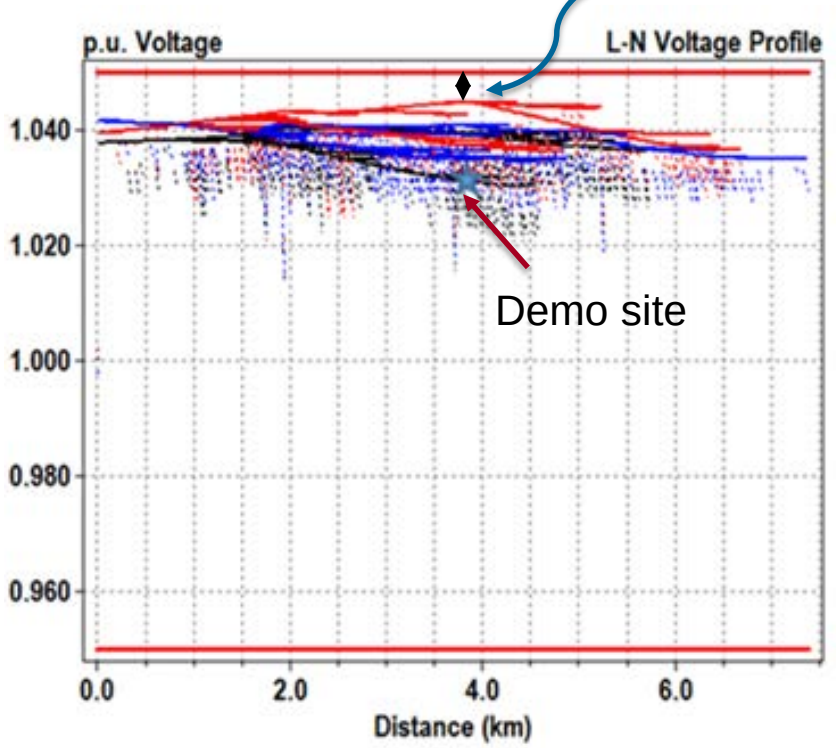
- Example demo site on a 12.47 kV feeder single phase lateral
- Feeder head voltage regulator
- 11 MW maximum load and 4 MW minimum load

http://energy.gov/eere/sunshot/sustainable-and-holistic-integration-energy-storage-and-solar-pv-shines

Feeder Voltage Profiles

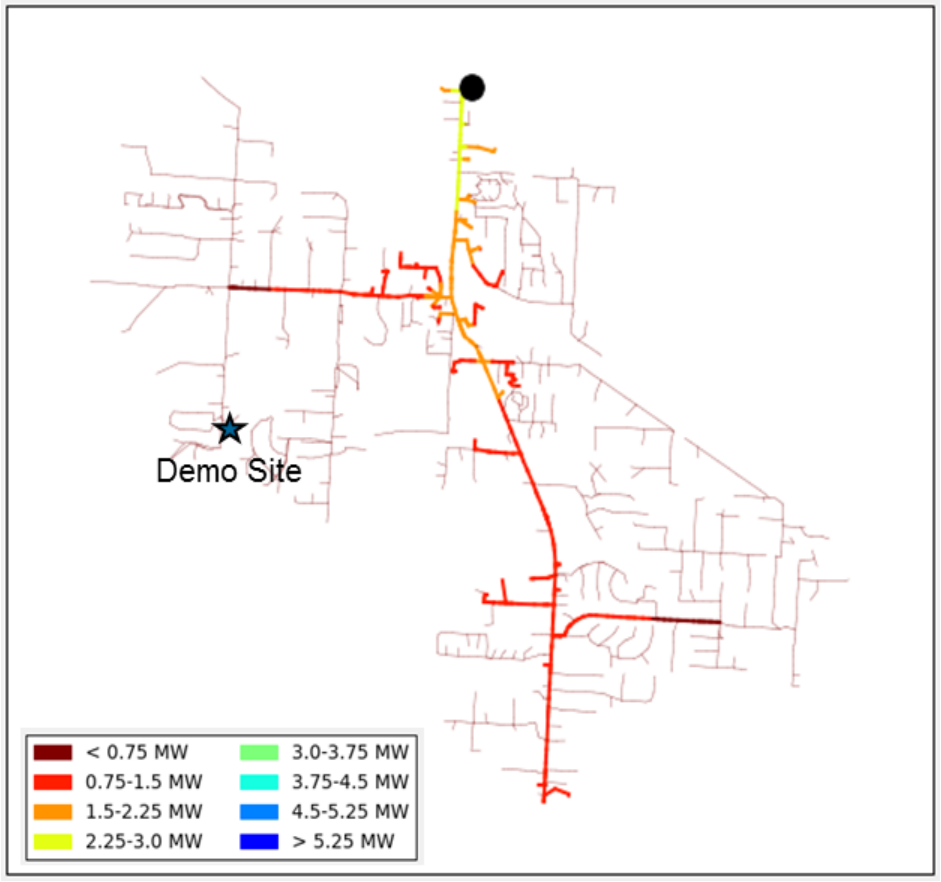


Voltage along feeder in maximum load



Voltage along feeder in minimum load

Site Hosting Capacities

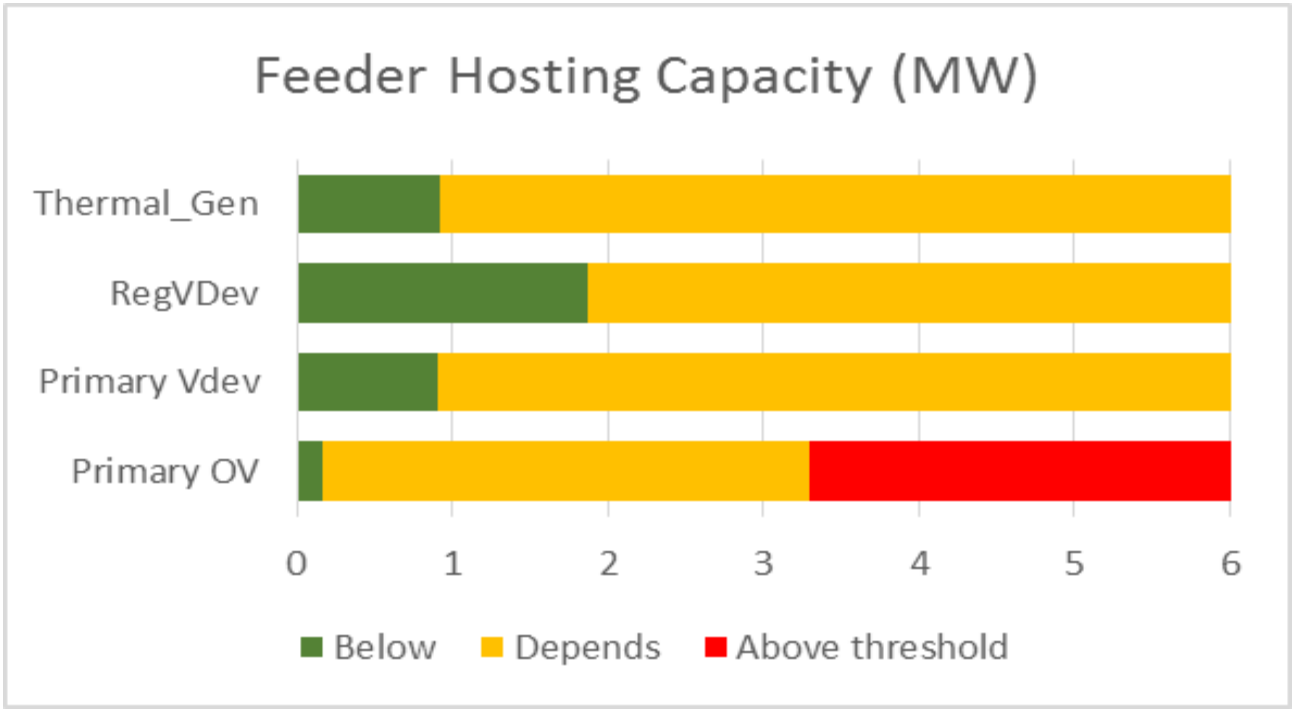


Node Level Hosting Capacity for Combined Issues

Site hosting capacity for individual issue

Issue	Hosting Capacity (MW)
Primary Over-voltage	0.17
Primary Voltage Deviation	0.9
Regulator Voltage Deviation	1.87
Secondary Over-voltage	0.03
Secondary Voltage Deviation	0.075
Thermal for Gen	0.92

Feeder Hosting Capacities



0.17 MW minimum hosting capacity

3.3 MW maximum hosting capacity

Voltage constrained feeder

Conclusions & Next Step

- DRIVE hosting capacity analysis effectively identifies the demo site original capabilities and the potential issues.
- Next phase, hosting capacities will be re-calculated with the proposed SHINES solution to evaluate the effectiveness of the solution

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