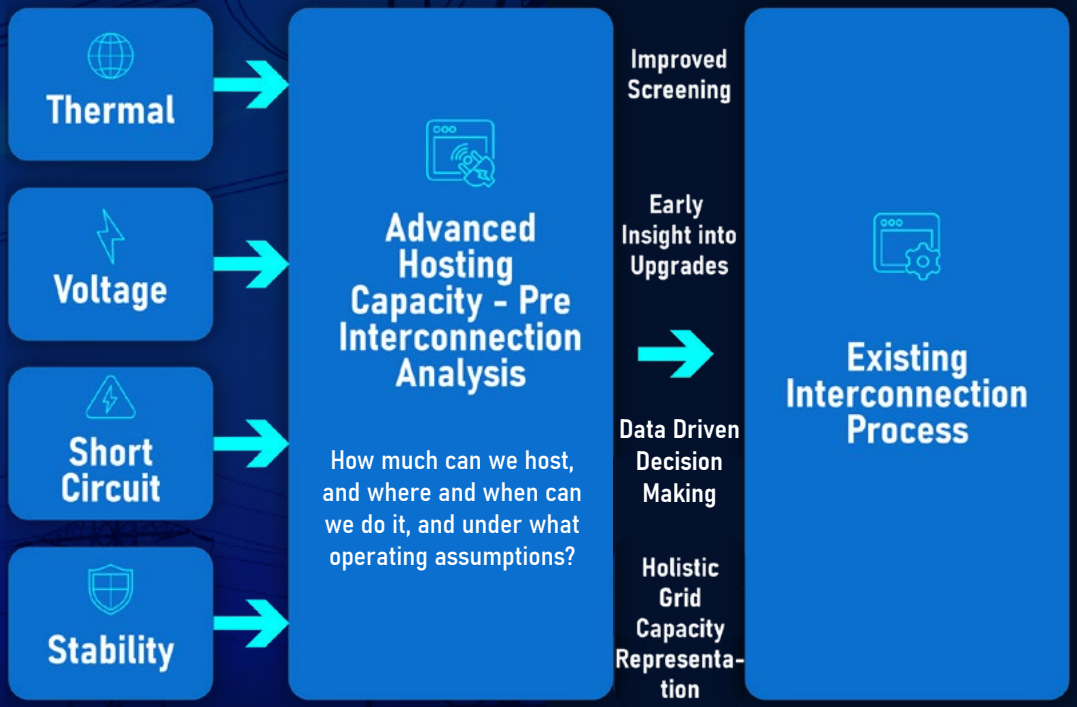
Powerful Pathways of Transmission:

Need for Enhanced Hosting Capacity

As load and generation interconnection queues increase and supply chains tighten, transmission planners and other stakeholders need to be able to quickly and clearly identify where resources can be more readily deployed. Transmission Hosting Capacity (THC) analysis methods help determine how much new generation and/or load the existing transmission grid can accommodate without compromising reliability or triggering significant upgrades.

These methods use power flow tools, data on the current grid, and information on potential generation and load seeking to connect to assess how much additional capacity can be accommodated at any given grid location. Such studies have recently been introduced in many regions looking to better manage interconnection challenges. As a result, utilities and system operators are progressing toward improved interconnection transparency by publishing transmission capability/hosting capacity maps. A few organizations, including AESO, AEMO, MISO, SPP, Elia, and RTE serve as examples.

To date, approaches to hosting capacity often focus solely on thermal constraints of the grid and sensitivity analysis on locations and sizes of resources and demand. While valuable for screening and early insight, thermal-only approaches are increasingly insufficient for today's scale and complexity of interconnection requests. A purely thermal lens can miss binding constraints tied to voltage performance, system strength/short-circuit ratio (SCR), stability limits, contingency behavior, or operational redispatch realities.



A New Approach to Hosting Capacity Analysis

Interconnection demand is rising quickly, and approximate methods can be inadequate to represent what limits the system as conditions evolve. Grid planners are moving towards adding screening for voltage and stability constraints. Building on these evolutions, the next step, what we are terming an Advanced Hosting Capacity, also referred to as headroom, could evaluate hosting capacity across multiple additional technical constraints, such as voltage, short-circuit ratio limits, stability limits, and beyond. This integrates practical considerations such as project clustering, timelines, dispatch strategy, and a range of operating conditions.

Similar to how hosting capacity is currently used, the Advanced Hosting Capacity approach does not replace any existing interconnection procedures currently in place. Instead, it can serve as a pre-interconnection strategy to improve the overall interconnection process by providing a more robust representation of current grid capacity and its geographic distribution.

Key Challenges and Considerations

The Advanced Hosting Capacity analysis can be powerful, but its strength depends on acknowledging real-world complexities, such as:

- Redispatch Strategy
- Project Timelines
- Site Considerations
- Operating Conditions
- System Upgrades
- Evolving Guidelines and Standards
- Flexible Large Loads
- Co-locating Generation and Load

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DCFlex: A Proposed Framework to Assess Headroom for Integrating Data Centers into Regional Power Systems
Link

A Deeper Dive

The Advanced Hosting Capacity analysis approach evaluates how much generation and/or load can be interconnected while preserving reliable operation under both normal and contingency conditions, using a multi-metric assessment rather than a single-constraint screen.

The Advanced Hosting Capacity expands hosting capacity beyond thermal screens by incorporating a broader metric evaluation, including: thermal constraints (like line/transformer ratings); voltage constraints (steady-state and contingency voltage performance); grid strength; stability limits (like voltage stability, transient stability, frequency-related considerations); operational constraints such as operating reserve and reliability practices; contractual obligations and operational requirements.

The Advanced Hosting Capacity, or headroom, approach is a practical and improved form of tradition transmission hosting capacity methods. By expanding beyond thermal screening and incorporating cluster effects, project timing, dispatch strategy, site realities, and diverse operating conditions, Advanced Hosting Capacity provides a more robust representation of what the grid can truly support.

How can EPRI help?

EPRI is actively engaged in addressing the questions that must be solved to accelerate interconnection while maintaining safe, reliable, and affordable power by developing methodologies and tools.

EPRI is working with various stakeholders to develop and demonstrate new approaches, leveraging existing R&D and advanced AI based approaches to support faster interconnection decisions without compromising the reliability and safety that communities depend on.

EPRI also collaborates through initiatives such as the DCFlex Initiative, transforming data centers from large, inflexible consumers into flexible grid-supporting assets; and the GET SET Initiative, helping utilities evaluate, deploy, and integrate Grid Enhancing Technologies (GETs) to increase transmission capacity.

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