ELECTRIC POWER ENGINEERS

How Much Early Grid Analysis is Enough?

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How Much Early Grid Anaylsis is Enough?

Every developer has spent time and resources on a site that should have been cut weeks earlier. The opposite is just as common, running a full engineering stack on a site before the land is even controlled. Neither is an ideal investment of time or resources.

> **The question isn't how much grid analysis to do. It's which analysis, and when.**

What follows are seven criteria that determine whether your early-stage evaluation, once a site is identified, is sufficient to support a confident development decision, before the real investment starts.

CRITERION

01

Determine Whether Physical Injection Capacity Exists

Can the transmission system absorb your generation?

Many developers still treat injection capacity as a binary question: **Can I connect or not? In reality, the more important question is how much risk you're taking on to get there.**

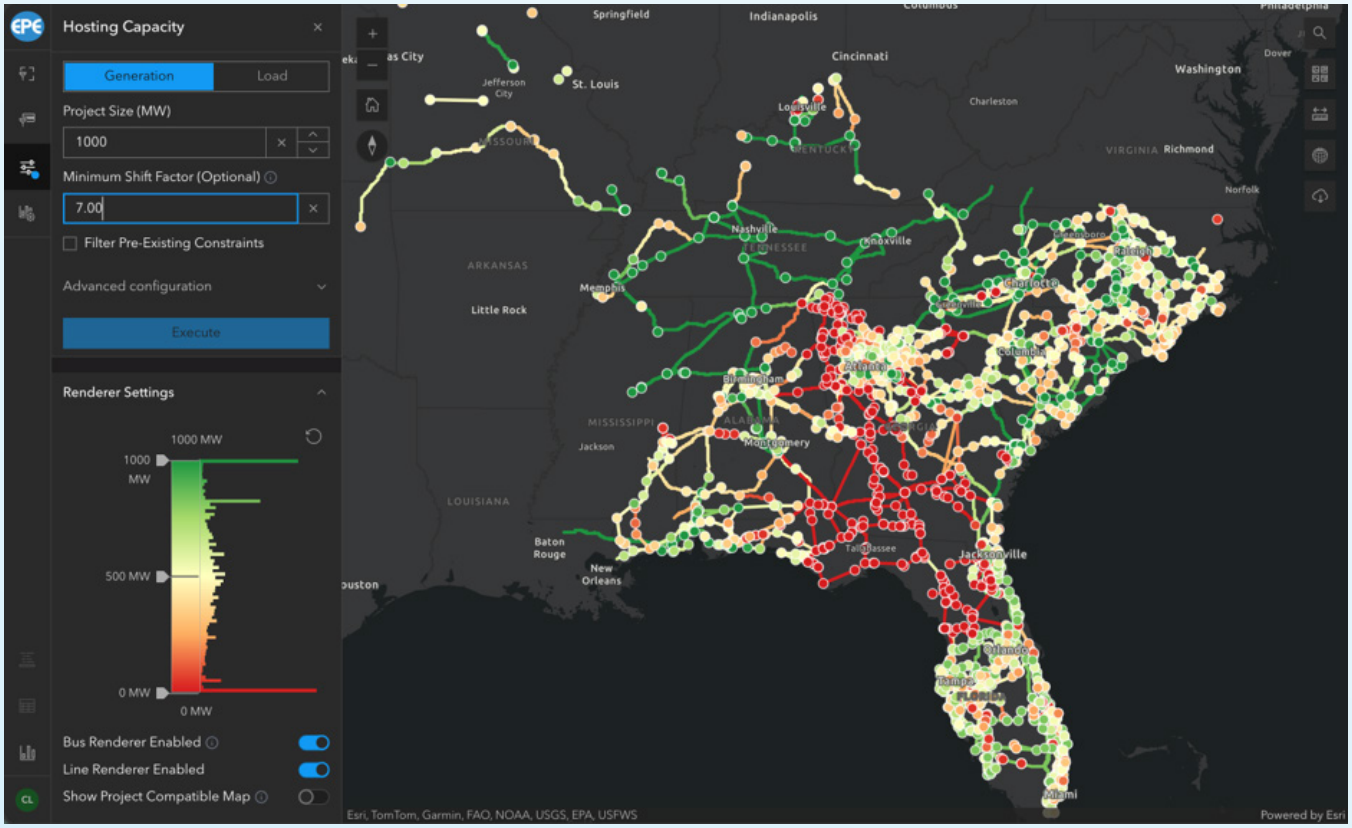
While some locations can accommodate new generation with little constraint exposure, most points of interconnection contribute to one or more transmission constraints. The challenge is understanding which constraints matter, how significantly they affect your project, and what those impacts mean for curtailment risk, upgrade exposure, and long-term viability.

Early injection analysis is not intended to replicate a formal interconnection study. Its purpose is to quantify risk before significant capital is committed. By evaluating injection capacity alongside shift factors, curtailment exposure, and estimated upgrade impacts, developers can distinguish between low-risk opportunities and sites that carry hidden technical or financial challenges.

Why Headline Capacity Can Be Misleading

A 200 MW solar project in West Texas may sit near strong 345 kV infrastructure and appear attractive on paper. But the real question is how that project interacts with the surrounding network. Which constraints does it affect? How severely? What curtailment risk does it face? Could future upgrades be required, and if so, what might they cost?

> **The goal is not to find a simple yes-or-no answer. It is to determine whether a site has a credible path to delivering power economically before deeper engineering begins.**



InSights displays compatible sites based on criteria entered.

In Practice with InSights

Developers use InSights to screen candidate buses against ISO-aligned power flow models used by EPE's Engineers before advancing land or permitting work. Injection screening and contingency-aware analysis help identify locations where apparent capacity disappears under N-1 conditions, allowing teams to eliminate constrained sites earlier in the process.

CRITERION

02

Understand What Actually Limits the System

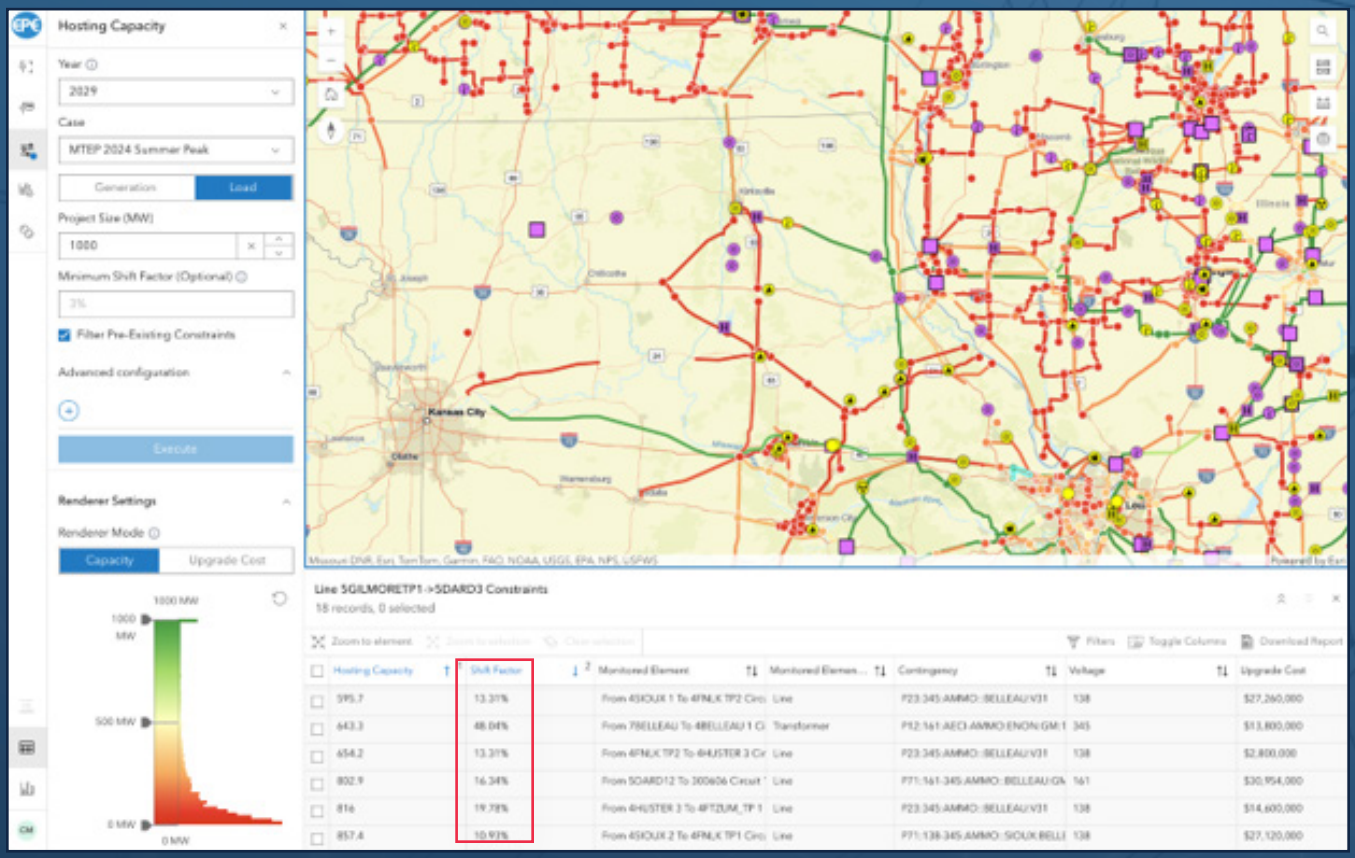
Finding a good bus is not the same as understanding why it's good.

Two buses with similar apparent capacity can perform completely differently, and you won't know which until you understand what is actually constraining each one.

The limiting factor is rarely the point of interconnection itself. It is usually a transmission element downstream, a specific line, transformer, or corridor that becomes stressed under particular operating conditions or contingency scenarios.

This is where shift factor (DFAX) analysis becomes important. DFAX measures how strongly a project's injected power flows across constrained transmission elements. Two projects injecting at similar buses may have very different impacts on the same constrained facility, resulting in materially different congestion exposure, curtailment risk, and upgrade requirements. A site can appear unconstrained under normal operating conditions and become heavily limited when a nearby transmission element is out of service during peak generation periods.

> **Without understanding the actual constraint driver and how a project interacts with it, developers often compare headline capacity numbers that may be misleading on both sides.**



InSights displays hosting capacity by varying shift factors and potential upgrade costs.

Adjusting the Shift Factor in InSights

Constraint-level visibility helps developers understand which monitored elements limit injection capability and how strongly a project contributes to congestion under contingency conditions. In InSights, shift factor (DFAX) analysis quantifies this relationship on a scale from 1–100%, allowing teams to compare candidate sites based on real congestion exposure and deliverability risk rather than headline MW availability alone.

CRITERION

03

Evaluate Queue Competition, Not Just Queue Position

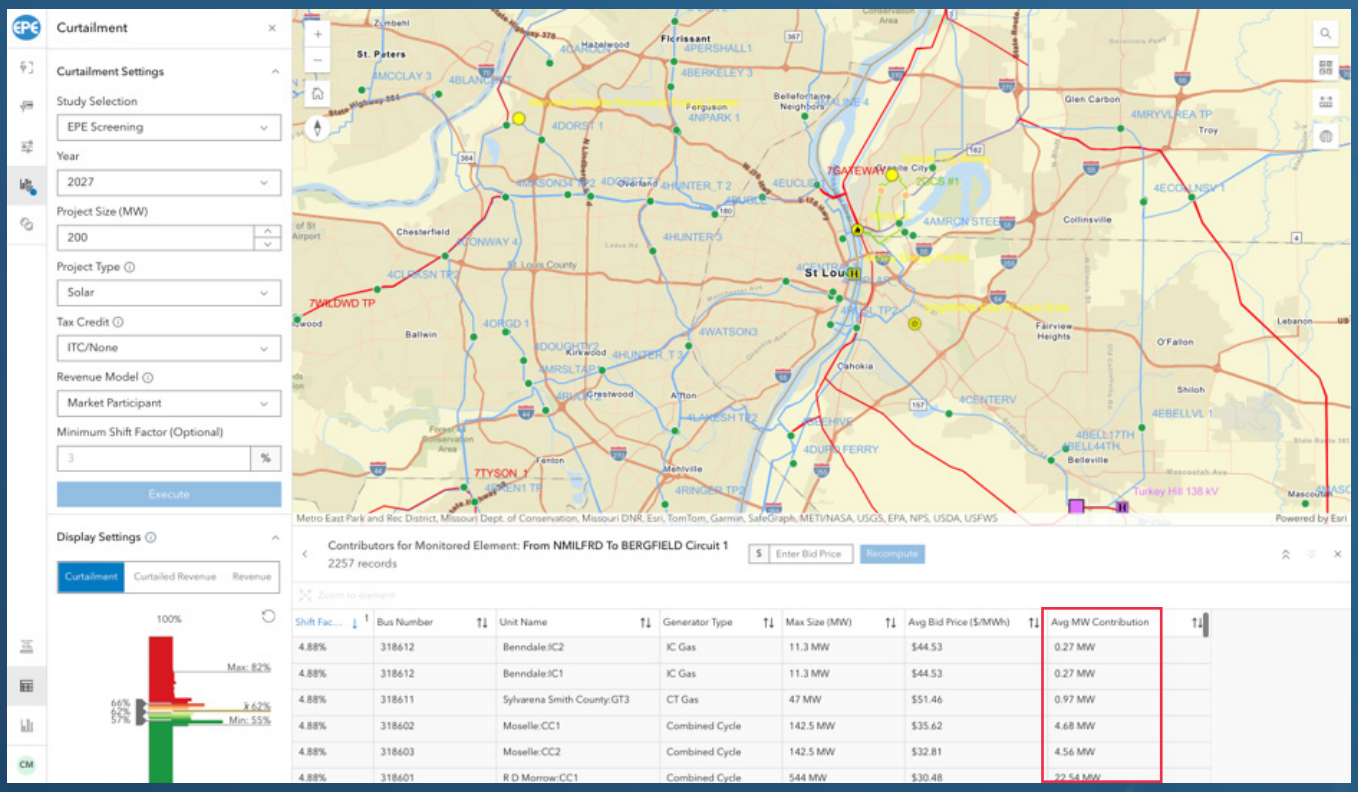
How much of the queue will actually consume deliverability?

> **Queue position tells you where you stand.**
> **It doesn't tell you what you're standing behind.**

The more important question is how the projects ahead of you affect your path to interconnection. Some may compete for the same constrained infrastructure, increasing congestion, curtailment risk, or upgrade exposure. Others may actually improve your position by supporting network upgrades that increase deliverability or unlock additional capacity in the area.

A region with 3 GW queued ahead of you may have far less meaningful competition once you account for project viability, funding certainty, and whether those projects interact with the same constraints you do. The reverse is also true. A region with relatively light queue activity can still carry significant risk if a handful of projects control the most attractive injection points or share critical upgrade dependencies.

Queue dynamics become even more important in regions that assign upgrade costs. When earlier projects withdraw, upgrades can be deferred to later queue cycles, shifting responsibility and cost to projects that remain. Understanding who contributes to constraints, who benefits from upgrades, and how queue attrition changes those outcomes is often more valuable than simply knowing how many megawatts are ahead of you.



InSights displays contributors by average MW contribution while also showing average bid prices, providing greater visibility into competing projects and their potential impact on grid availability.

What to Look for in InSights

Rather than relying on raw queue volume alone, developers can use InSights to identify the projects that are electrically competing for the same transmission capacity. In power systems, physical distance is often less important than electrical distance. A project located hundreds of miles away may have nearly the same impact on a constrained facility as a project next door if both share similar shift factors.

By visualizing contributor relationships, shared upgrade dependencies, and electrical proximity to constraints, InSights helps distinguish nominal queue congestion from the projects most likely to influence deliverability, upgrade exposure, curtailment risk, and long-term interconnection viability.

CRITERION

04

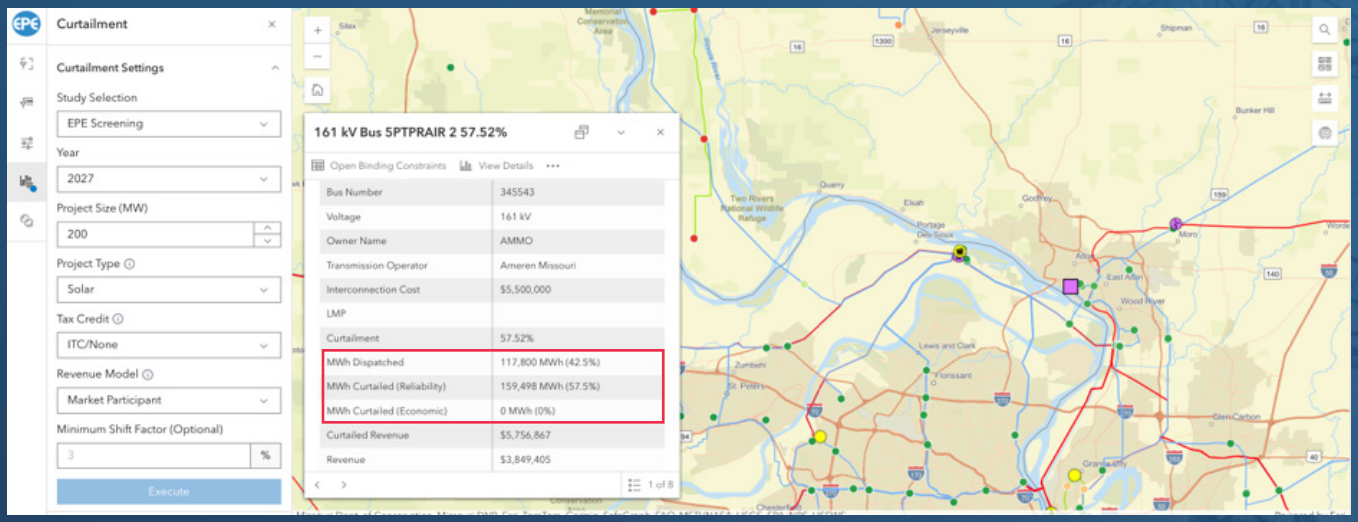
Assess Curtailment Risk Before Entering the Queue

Interconnection approval and commercial viability are two different tests.

Two solar projects in the same ISO can have nearly identical interconnection outcomes. But if one sits in a region that regularly sees negative LMPs during peak solar hours and that region is getting more saturated every year, the revenue profile over a 25-year life looks nothing like the pro forma suggested at origination.

> **This is increasingly a financing issue, not just a development one. Lenders and tax equity investors are getting more sophisticated about curtailment exposure.**

A project that can't demonstrate credible long-term revenue under realistic grid conditions has a harder path to close.



InSights displays detailed information such as MWh curtailed due to reliability concerns, congestion, and price.

Applying This Analysis in InSights

Developers use InSights to evaluate LMP trends and frequency, renewable saturation, hourly congestion exposure, and basis risk before entering the queue. Historical and forward-looking market analysis helps teams identify locations where technically feasible projects may still face elevated curtailment, negative pricing, or weaker long-term revenue potential. Interconnection approval may be necessary for viability, but it does not guarantee economic success.

CRITERION

05

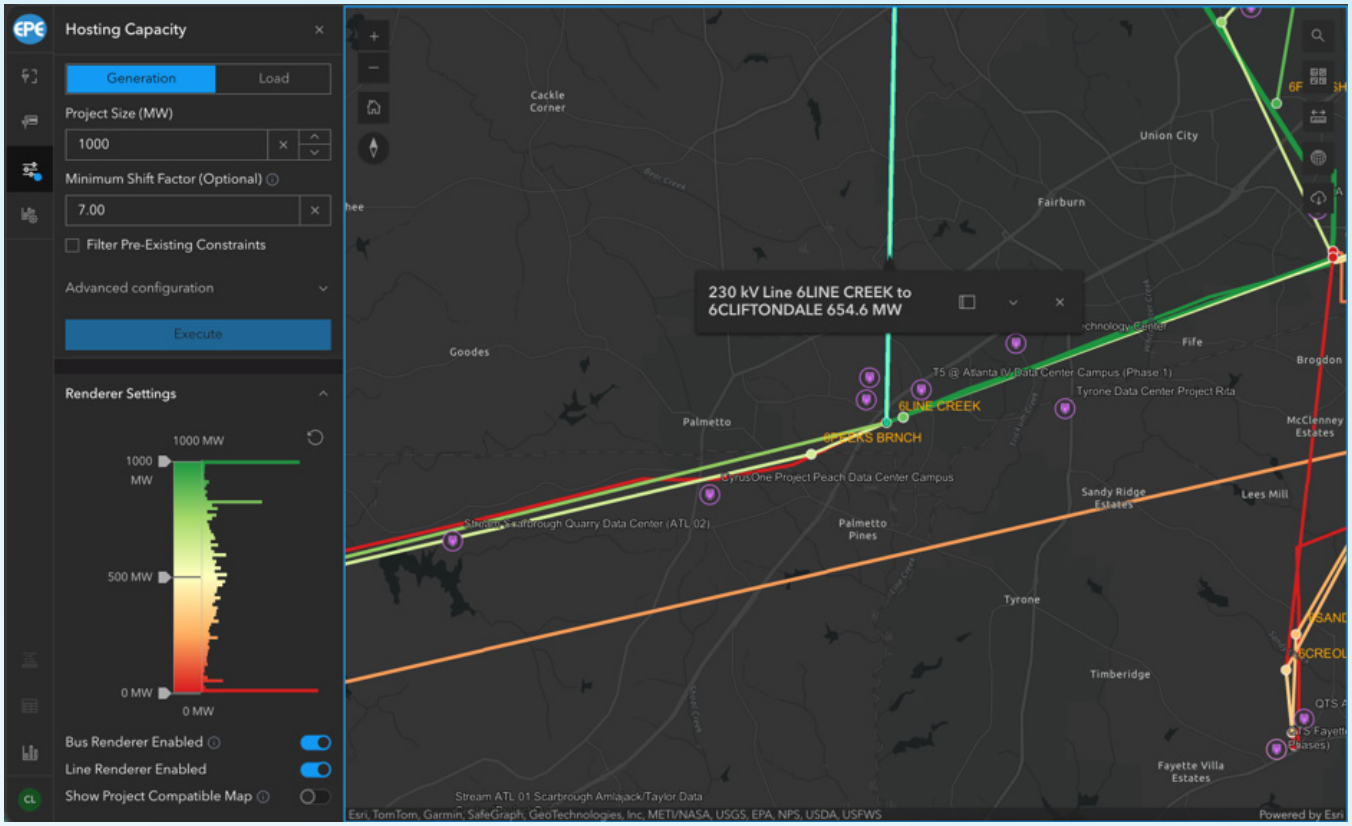
Evaluate Future Grid Conditions, Not Just Current Conditions

The grid you build into is not the grid you operate on.

A site analysis based entirely on today's grid is an analysis of a system that will no longer exist by the time your project reaches commercial operation.

Planned transmission upgrades, generator retirements, and load growth, particularly from data centers, which are reshaping local load forecasts faster than any other factor right now, can dramatically change how a site performs. A location with limited injection headroom today may become substantially more attractive if a major transmission expansion is funded and scheduled within your development timeline. An unconstrained area today can become heavily saturated if renewable buildout outpaces transmission investment. But grid dynamics work both ways. A congested renewable region can rapidly open up when a major new load, such as a data center, enters the market and creates demand for excess generation. Understanding how both generation growth and load growth reshape transmission constraints is critical to assessing long-term project viability.

> **This doesn't require modeling every scenario. It requires enough forward visibility to know whether grid fundamentals at your site are improving, deteriorating, or likely to stay flat over time.**



InSights showing generation capacity around major datacenter site prospects

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In Practice with InSights

InSights allows developers to evaluate candidate sites against evolving grid conditions, including planned transmission upgrades, generator retirements, data center buildouts, and changing system topology. This helps teams avoid making long-term development decisions based solely on present-day grid conditions.

CRITERION

06

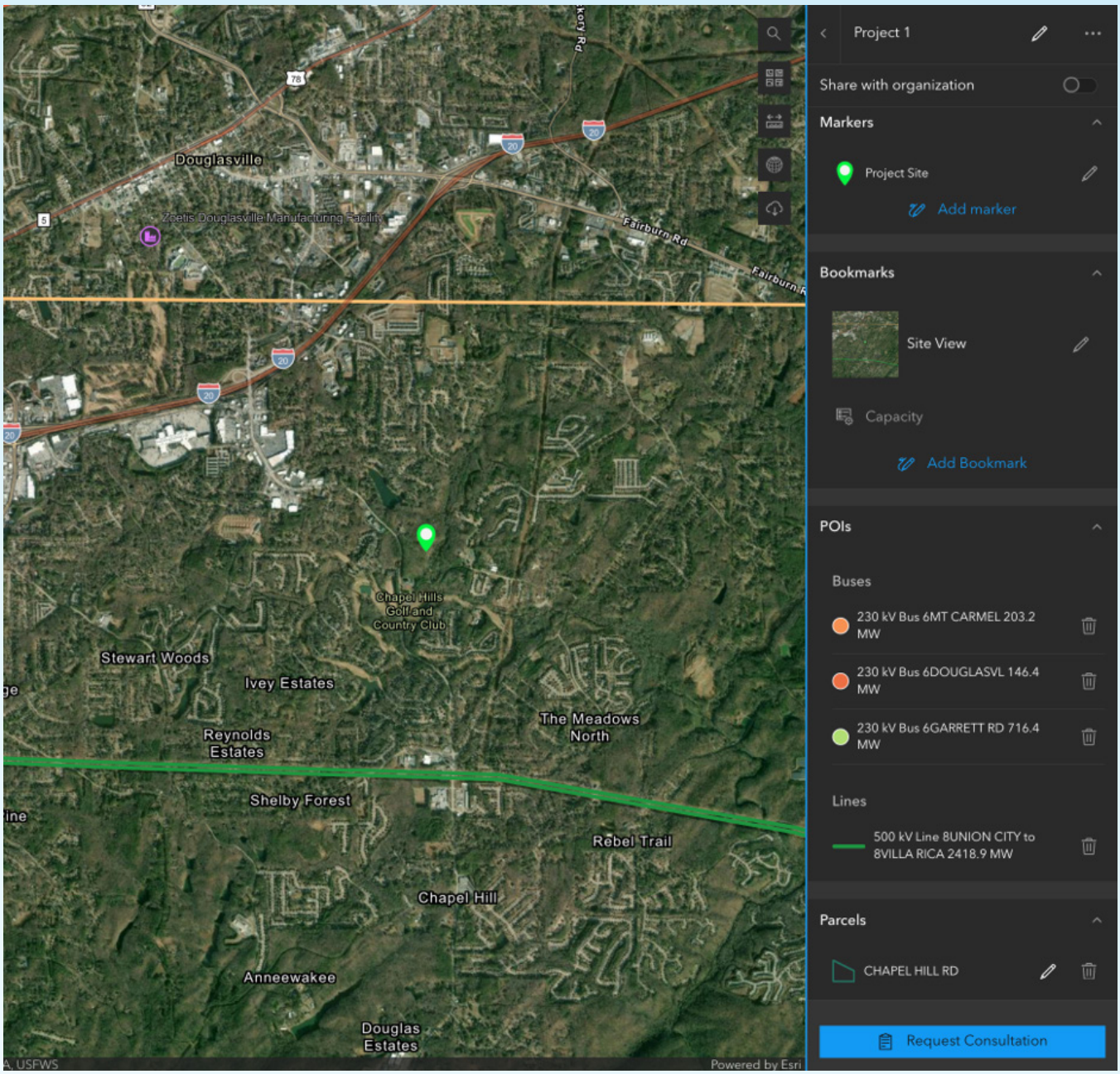
Match Analysis Depth to the Stage of Development

More analysis is not better analysis.

> **Running detailed engineering studies on sites that haven't cleared a basic queue screen is a common and expensive mistake. So is advancing a project to queue entry with nothing but a high-level congestion map.**

The right amount of analysis depends on how much capital is at risk. During early screening, when you're evaluating dozens or hundreds of candidate sites, the goal is fast elimination of non-viable options. High-level injection review, queue analysis, and regional congestion patterns are typically enough.

As a site advances and capital exposure increases, the analysis should deepen in parallel. By the time you're finalizing land control or approaching queue entry, you should have constraint-level visibility, a credible curtailment assessment, and enough forward-looking data to defend the site's economics to a financing counterparty.



InSights displays candidate POIs to help teams identify the best interconnection opportunities.

Applying This Analysis in InSights

Development teams use InSights to identify, shortlist, and prioritize the most promising POIs before investing in deeper engineering studies. This allows teams to focus their time, capital, and technical resources on the opportunities most likely to advance successfully through interconnection and development.

CRITERION

07

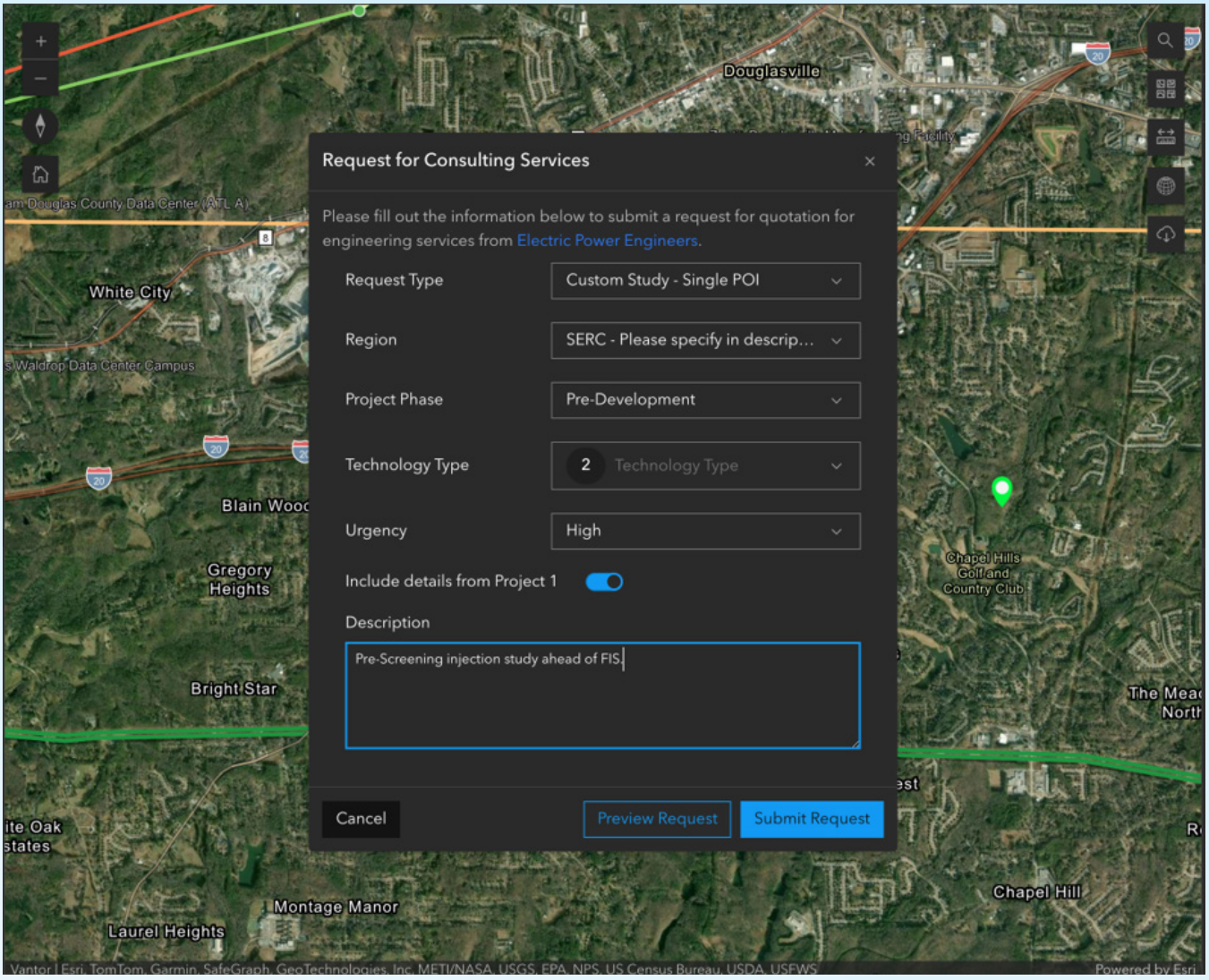
Know When to Escalate to Detailed Engineering

Early analysis finds the risk. At some point you need to quantify it.

Early-stage grid analysis is not designed to produce the same outputs as a formal interconnection study. It's designed to make sure that when you do run those studies, you're running them on the right projects.

> **The escalation trigger is usually one of three things: land control is being finalized, queue entry costs are becoming material, or a financing counterparty is asking questions that require more than a screening-level answer. At that point, the level of analysis needs to match the level of commitment.**

Advanced engineering using detailed power flow studies, stability analysis, dynamic modeling, and production cost simulation can be expensive and time-consuming. The developers who use it well are the ones who have already done enough early work to know exactly which sites deserve it.



The InSights readiness form provides direct access to EPE engineers to assess whether your project is ready to advance.

Using InSights with Direct Access to Engineering Expertise

Early-stage screening helps identify which projects justify deeper engineering evaluation. InSights is built using the same ISO-aligned power flow models and transmission assumptions EPE's engineers use in advanced study work, allowing developers to move from portfolio screening into deeper technical analysis with greater continuity in models, assumptions, and workflow. As projects mature, teams can also engage directly with EPE's engineering experts through the platform to assess readiness for advanced studies, queue entry, and more detailed interconnection evaluation.

Conclusion

There's no universal threshold for how much early grid analysis is enough.

The developers who consistently advance successful projects aren't doing more analysis. They're doing the right analysis at the right time.

What there is: a set of questions that need credible answers before meaningful capital goes in. As queues grow more competitive and transmission systems more constrained, the developers who get this sequencing right will have a durable edge over those who don't.

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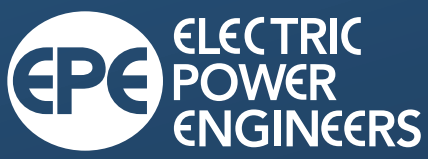
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